Red Line Extension to Alewife: Before/After Study—Appendices

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Red Line Extension to Alewife: Before/After Study
December, 1987

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Metropolitan Area Planning Council

APPENDIX A
RED LINE EXTENSION LAND USE STUDY

ABOUT THIS REPORT

The Metropolitan Area Planning Council is the officially designated regional planning agency for the 101 cities and towns of metropolitan Boston. The Council helps its member communities plan in the areas of economic development, land use, housing, population growth, transportation and environmental quality.

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CHAPTER 1

EXECUTIVE SUMMARY

The purpose of this study is to determine the impact of the Red Line Extension on land uses and values in the neighborhoods surrounding the new stations at Porter Square, Davis Square and Alewife. The findings show that the development of the new stations encouraged early and extensive planning and cooperation by the communities, the MBTA and state and federal government agencies.

The greatest impact of the construction was seen at the Alewife station. In preparation for the opening of the station, the city of Cambridge began the Alewife Urban Design Study. This process led to the rezoning of 400 acres of underutilized land from industrial to office use, resulting in the construction of over one million square feet of office space and the creation of 2000 jobs in the last eight years. Much of this development took place adjacent to or near the new station along Cambridgepark Drive, formerly the Ringe Road Extension. Whether this rate of new development will continue depends on how rapidly the area's current 19% vacancy rate can be reduced.

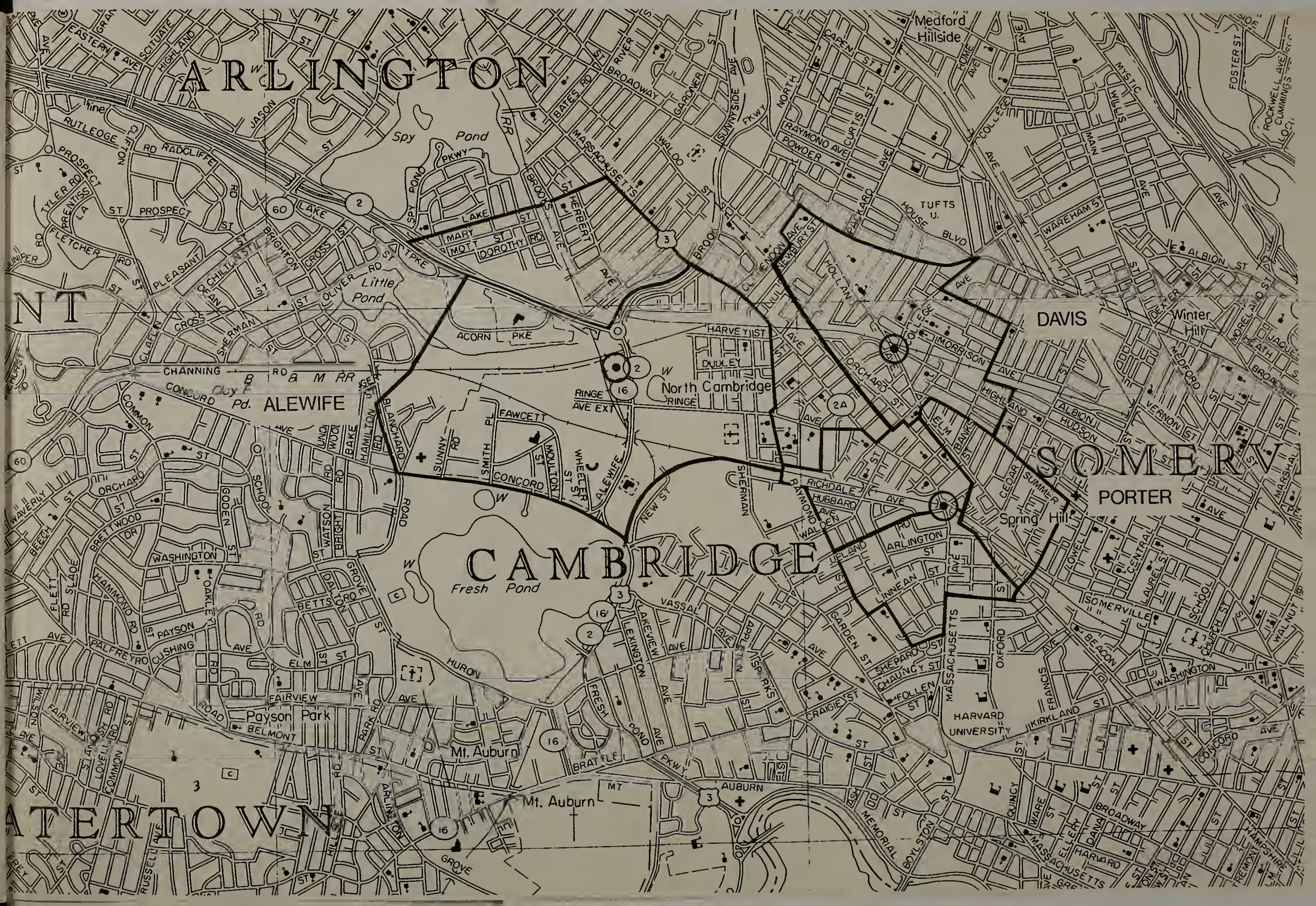
The next greatest impact was seen at Davis Square in Somerville. Using the new Red Line station as the cornerstone, the city of Somerville began to plan for the revitalization of Davis Square by creating the Davis Square Task Force, drawing upon city officials, local merchants and Davis Square residents. The result was a program to renovate existing buildings

Table 1.1

LAND USE CHANGES IN THE STATION AREAS
(Percent of total acreage)

	1978	1986	Percent change
CAMBRIDGE			
Alewife:			
Industrial	36.2	22.8	-37
Consumer Goods and Services	12.5	11.6	-7
Office Structures	8.9	34.1	91
Open Space, Developed and Undeveloped	29.5	34.1	16
Porter:			
Residential	53.5	55.6	4
Industrial	6.7	5.8	-13
Consumer Goods and Services	23.2	20.1	-13
Office Structures	1.1	3.2	190
SOMERVILLE			
Davis:			
Residential	38.5	39.4	2
Commercial (Office, Retail)	24.8	27.4	10
Parking/Open Space	15.1	22.1	46
Industrial	6.3	.6	-90

and plan for new construction, namely the Buena Vista project next to the Davis Square station, as well as to improve traffic flow, parking and recreational facilities in Davis Square. Also, the Square was designated a Commercial Area Revitalization District (CARD), allowing state financing of renovations and new construction. Once the station opened, businesses in the immediate vicinity of the station showed increased sales, the amount of commercial land uses (office and retail) rose by 10% and parking spaces increased by 46%, reflecting the needs of local merchants and residents. Accordingly, industrial use of land decreased significantly (see Table 1.1).


ARLINGTON
CAMBRIDGE
SOMERV
ATERTOWN
NT
DAVIS
PORTER
ALEWIFE
North Cambridge
Spring Hill
Winter Hill
Medford Hillside
TUFTS U.
HARVARD UNIVERSITY
Spy Pond
Little Pond
Fresh Pond
Clay Pd.
Payson Park
Mt. Auburn
Mt. Auburn
MASSACHUSETTS AVE
BROADWAY
CONCORD AVE
ALEWIFE BROOK PKWY
FRESH POND PKWY
BRATTLE ST
MEMORIAL DR
HURON AVE
BELMONT ST
MT AUBURN ST
LAKE ST
RINGE AVE EXT
RICHDALE AVE
HUBBARD AVE
WALDEN ST
HIGHLAND AVE
ELM ST
SUMMER ST
COLLEGE AVE
BOSTON AVE
KIRKLAND ST
WASHINGTON ST
BEACON ST
SOMERVILLE AVE
B & M RR
2
2A
3
16
60

At Porter Square, a similar planning effort took place, but the goal of city officials and local residents was to preserve the character of the neighborhood. Thus, only slight changes took place: there was a small rise in residential and office use (due to three new housing and two new office complexes, see Table 1.2), while industrial and retail uses slightly declined. The primary reason for this change was the availability of inexpensive office space and parking, although the Red Line Extension had some impact. However, as in Davis Square, the businesses within sight of the station have seen an increase in sales.

Another part of the study focused on changes in housing prices near the new Red Line stations. Due to the increased access provided by the new

Table 1.2

NEW DEVELOPMENT BY STATION AREA, 1980-1986

	Number of Completed Projects	Square Footage	Number of Proposed Projects	Square Footage
CAMBRIDGE				
Alewife	6 office 1 office/ retail	1,006,900	4 office 1 office/ retail 1 mixed use	2,137,000
Porter	2 office 3 housing	115,000 (70 units)	1 retail 1 retail/ office	270,000
Harvard	1 office/ housing	200,000 (70 units)	none	
SOMERVILLE				
Davis	2 office 1 office/ retail	50,000	1 office/ retail	100,000
	1 housing	(53 units)		
TOTAL		1,371,900		2,507,000

transit service and the general improvement in the appearance of the commercial areas surrounding the stations, one would have expected that housing prices in the impact areas might have increased faster than the cities as a whole. This did occur in two areas, the Cambridge neighborhood near Alewife and the Somerville area near Porter Square. In the other areas, prices rose at about the same rate or more slowly than those of the cities in which they were located. The two locations where prices did increase at a faster rate had the least expensive prices in the base year of the study (see Table 1.3).

In the opinion of real estate brokers polled for this study, the presence of the Red Line Extension has not yet been a major factor in the recent increase in housing prices. However, some experts have suggested that housing values may lag improvements in transportation accessability by several years.

Table 1.3

MEDIAN SALES PRICE FOR ONE- TO THREE-FAMILY HOMES

	1980 (1981)	1985	Percent Change
BOSTON AREA (one-family)	$79,400 (1981)	$144,800	82
ARLINGTON (two-family)	85,226	193,760	127
Alewife (two-family)	80,631	188,486	133
CAMBRIDGE	85,000 (1981)	179,000	110
Alewife	65,500 (1981)	148,000	126
Porter, North	95,000 (1981)	184,000	93
Porter, South	200,000 (1981)	292,750	46
SOMERVILLE	45,650	138,000	202
Davis	52,000	155,000	198
Porter	46,450	155,000	234

Sources: National Association of Realtors, Arlington Planning Department, Cambridge Board of Assessors, Somerville Board of Assessors.

The changes which occurred at Porter Square, Davis Square and Alewife would have happened even without the added service, especially at Porter Square and Alewife. However, the extension of the Red Line was responsible for encouraging and quickening the development of these neighborhoods by providing the motivation to plan and the atmosphere of cooperation between many different governments, local groups and agencies to take full advantage of the new transit improvements being proposed.

The long-term demographic impacts of the Red Line Extension within the neighborhoods surrounding the stations cannot be completely known until data is available from the 1990 census, around 1992. At this time, the MBTA should consider a new study of land values, uses and socio-economic change surrounding the Red Line Extension stations to establish whether housing prices eventually rise at a rate which will reflect their improved accessability to the transportation system.

CHAPTER 2

LAND USE AND ECONOMIC DEVELOPMENT IN THE STATION AREAS

Transportation has been a central focus of the planning efforts of the City of Cambridge for almost four decades. The public debate over the proposed inner belt absorbed public officials and community residents for almost twenty-five of those years, as decision makers struggled to accomodate the need for efficient access to the metropolitan core with the emerging goals of neighborhood preservation.

North Cambridge and West Somerville were a part of that debate from the beginning. One of the first proposals for an inner belt was included in the Metropolitan Master Highway Plan of 1948, and suggested a connector linking Route 2 with the inner belt, with interchanges at Alewife and Porter Square.

The inner belt proposal was permanently put to rest in 1974, when a decision was made not to construct a number of controversial highway projects in the Boston area. The focus of transportation planning within Route 128 shifted instead to the improvement of the mass transit system through the upgrading of equipment and the extension of service. The latter included the relocation of the Orange Line to the Southwest Corridor, the extension of the Orange Line to Malden and the extension of the Red Line to Braintree in the south and to Alewife in the north. In the Spring of 1985, the extension of the Red Line from Harvard Square was completed and opened to service.

A number of MBTA stations built within the last 20 years have been followed by a considerable amount of new development, generally in areas where a substantial amount of land was available, such as around North Quincy station, Wellington station in Malden and at the Alewife station.

Theories of Land Use

According to theories of land use, urban land use follows a pattern within a metropolitan area which reflects the area's history and a series of relationships between different types of land uses. The primary use, whether it is manufacturing, research and development or office space, is determined by the costs of using that parcel of land, such as rent or transportation. There are also other considerations like the condition of the building or neighborhood, zoning restrictions and other legal matters or tax benefits. Once these primary businesses are established, their employees seek housing in the area and secondary businesses appear. These secondary businesses are those who service the main businesses: office supply stores, restaurants, convenience stores, parts suppliers and the like. Also, consumer goods and services begin to grow to service the needs of the employees living in the area. The decision of who gets which piece of land is based on whoever is willing to pay the highest price.

In the Boston SMSA, financial institutions, such as banks and insurance companies and high-technology research, development and manufacturing firms have become the most visible of the area's primary businesses. Downtown Boston has experienced an unprecedented boom in office construction serving the needs of the financial sector, while the outlying areas, in particular along Route 128, Route 495, and Route 9, have experienced major development from expanding high-tech companies and the "back-office" operations of financial institutions.

As employees and secondary businesses make new decisions based upon these trends, one of the principal costs associated with an individual location is transportation. In particular, residential users are assumed to add the cost of transportation, especially the commute to the work, when considering the price for a home with the look, feel and services they desire. This notion attempts to explain why single-family homes cost less the farther they are located from employment centers, and why downtown Boston's economic renaissance has fueled rapid price increases in older urban neighborhoods which a few years earlier were suffering from deterioration and abandonment.

Transportation costs are assumed to have two components- the out-of-pocket costs and the value of the commuter's time. Thus, transportation improvements, such as the Red Line Extension, would be expected to alter the relative locational advantages of individual sites found in the communities located within its zone of service. This is because even though the physical distances between destinations have not changed, the time (and inconvenience) required to travel those distances has been substantially reduced.

In 1977, the U.S. Department of Transportation studied land use changes and economic development which accompanied major transportation improvements throughout the United States and Canada, including Boston. Entitled Land Use Impacts of Rapid Transit, the study found that economic development and land use changes did not occur automatically in the wake of mass transit improvements. Other factors had to be present as well, including:

1. Strong demand for office, retail or housing development. The study found that the timing of land use impacts was largely dependent upon economic conditions,

2. Land use policies and other local policies governing development. Local land use policies and policies regarding the provision of infrastructure must allow intensification of use. Transit improvement, the study found, often acts as a catalyst for change in those policies.

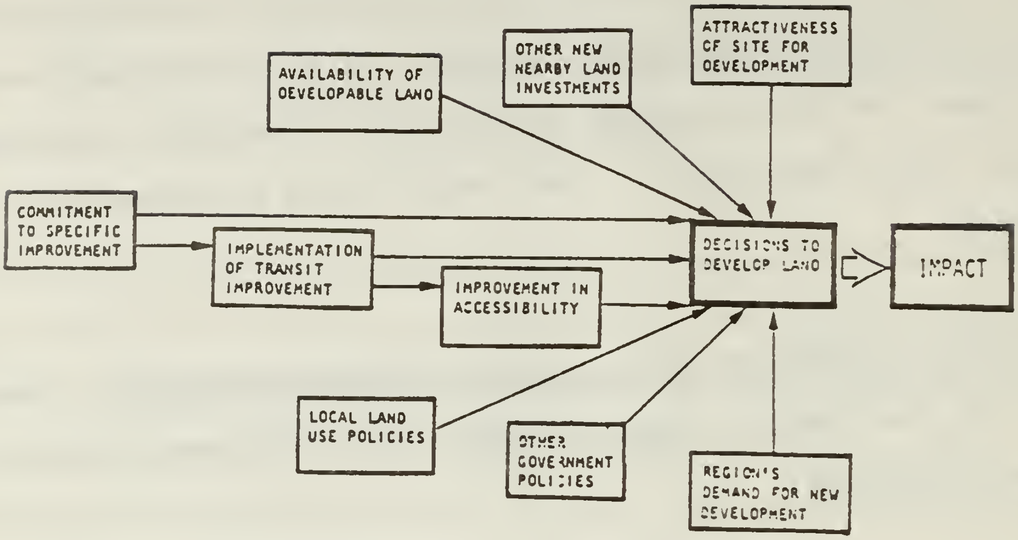
3. The availability of land at reasonable risk and cost, and

4. The attractiveness of the land for development.

Figure 2.1, reproduced from the DOT study, indicates how these and other factors were found to influence the land use impacts around new transit stations.

Relying on an MAPC report, the study found the North Quincy Red Line station, which opened in 1971, to be a case in point. The construction of the station was accompanied by zoning changes and construction of a new

Figure 2.1


AVAILABILITY OF DEVELOPABLE LAND
OTHER NEW NEARBY LAND INVESTMENTS
ATTRACTIVENESS OF SITE FOR DEVELOPMENT
COMMITMENT TO SPECIFIC IMPROVEMENT
IMPLEMENTATION OF TRANSIT IMPROVEMENT
IMPROVEMENT IN ACCESSIBILITY
DECISIONS TO DEVELOP LAND
IMPACT
LOCAL LAND USE POLICIES
OTHER GOVERNMENT POLICIES
REGION'S DEMAND FOR NEW DEVELOPMENT

roadway by the city of Quincy, and the construction by the state of a new bridge over the Neponset River. The availability of land at a reasonable cost, the improved access, and the generally supportive zoning regulations encouraged new development.

A major 80-acre complex was developed near the station, containing over 900,000 square feet of office space for the State Street Bank and the Kemper Insurance Company. According to the DOT report:

> The Bank did an employee's survey on residential location and discovered that many lived to the south and southwest of downtown Boston. Their studies also showed that transit was important to the region's largely female, young clerical labor pool on which the Bank depended.[1]

In the opinion of the DOT study authors, the local response to the development effects of transit improvements was thus critical to the ultimate impact. That reaction could be positive, resulting in a coordinated public effort to promote land development, or it could be negative, resulting in the adoption of steps to inhibit development. The authors saw the latter reaction as a "substantial threat to the achievement of a justifiable level of societal benefit."[2]

The DOT study looked briefly at proposed improvements in the Boston area, including the Red Line Extension to Alewife. The authors predicted, "of the three station sites, Alewife offers the greatest development potential due both to available land and good road access."[3]

The 1977 DOT report proved prophetic, both in terms of the outcome of the Red Line Extension and the forces which influence land use change. The following sections of this report identify major development projects, overall land use changes and other possible impacts in the commercial and industrial areas in the immediate vicinity of the new Red Line stations.

The Impact of the Red Line

The most dramatic changes have been around the Alewife station, where a substantial amount of land was vacant or underutilized at the time of the Red Line development. The shift from industrial to office use at Alewife has been great, and land values have increased astronomically, perhaps by as much as 400%, over the last five years. In both Porter and Davis, changes are evident as well, though not at the same rate.

Given the significant shift in the employment base from manufacturing to service throughout the region and the way that shift has influenced the Red Line Extension communities, most of the changes around the station areas may have happened eventually of their own accord. The Red Line, however, has likely accelerated that process, perhaps considerably, by acting as a stimulus for active public and private participation in the planning and redevelopment of the station areas. By encouraging the provision of improved public services in the station areas and through greater access, the MBTA made these areas more competitive with other commercial centers within the Red Line communities and in the region.

Before moving to a discussion of the areas around the new stations, a mention should be made of the development spurred by the Red Line Extension in Harvard Square. While there is little reason to believe that the Extension has had a fundamental impact upon the Square itself, the construction of the Extension did free up for development the former site of the MBTA's Bennet-Eliot yards. This major parcel has subsequently been developed by Hines Industrial Corporation and Harvard University. This site now houses University Place, which includes 200,000 square feet of office development, 70 new luxury condominium units, the John F. Kennedy Library and a new park on Memorial Drive across from the Charles River.

In the following chapters, land use changes and the economic development around the three new stations will be reviewed in detail. In the final two chapters, the changes in housing prices around the new stations will be discussed.

CHAPTER 3

CAMBRIDGE

Since the end of the Second World War, Cambridge has experienced the decline in traditional manufacturing employment typical of most core cities. In recent decades, the city has begun the transformation to a service and high-technology base. Between 1970 and 1980, manufacturing employment in the city declined by over 27%, while service employment increased by 333%.

As early as the mid-1960's, Cambridge city planners had recognized that the city was going to have difficulty retaining traditional manufacturing enterprises, and that office and research and development were to be the keys to the city's economic future. Though momentum gained slowly, by the late 1970's, the local commitment to economic development began to pay off. Demand for space around MIT breathed life into the city's Kendall Square Urban Renewal Project, with much of the funding coming from the MBTA and the U.S. Department of Transportation Urban Mass Transportation Administration. In 1980, Cambridge applied for and received funds from the federal Urban Development Action Grant (UDAG) program to support a major redevelopment project in the Lechmere Square area, a project now nearing completion. EDA funds were also obtained to support redevelopment in the Alewife area.

As a result of these projects and other real estate developments, Cambridge now has approximately 6.2 million square feet of first class research and office space, three times the amount of four years ago, according to the real estate firm of Spaulding and Slye (S&S). They characterized the Cambridge market in its April, 1984 market survey:

> The Cambridge office market is now being recognized as a market unto itself, and most of the tenants have come from within the area, primarily from sophisticated high-tech firms and professional firms such as engineering, genetic research, and defense related companies. These firms have been growing and contributing to the high level of activity in this market.[4]

A. Alewife

> One of the most visible characteristics of Alewife is the pattern of railroad tracks and major roadways which cross and intersect the area. Route 2 intersects the Alewife Brook Parkway at the Dewey and Almy Circle, and connects with primary commuter routes to Cambridge and downtown Boston. Railroads include the B&M Fitchburg Branch, the Bedford Branch, and the Freight Cut-Off, all of which service the Alewife industries.[5]
>
> Alewife Open Space Report, 1979

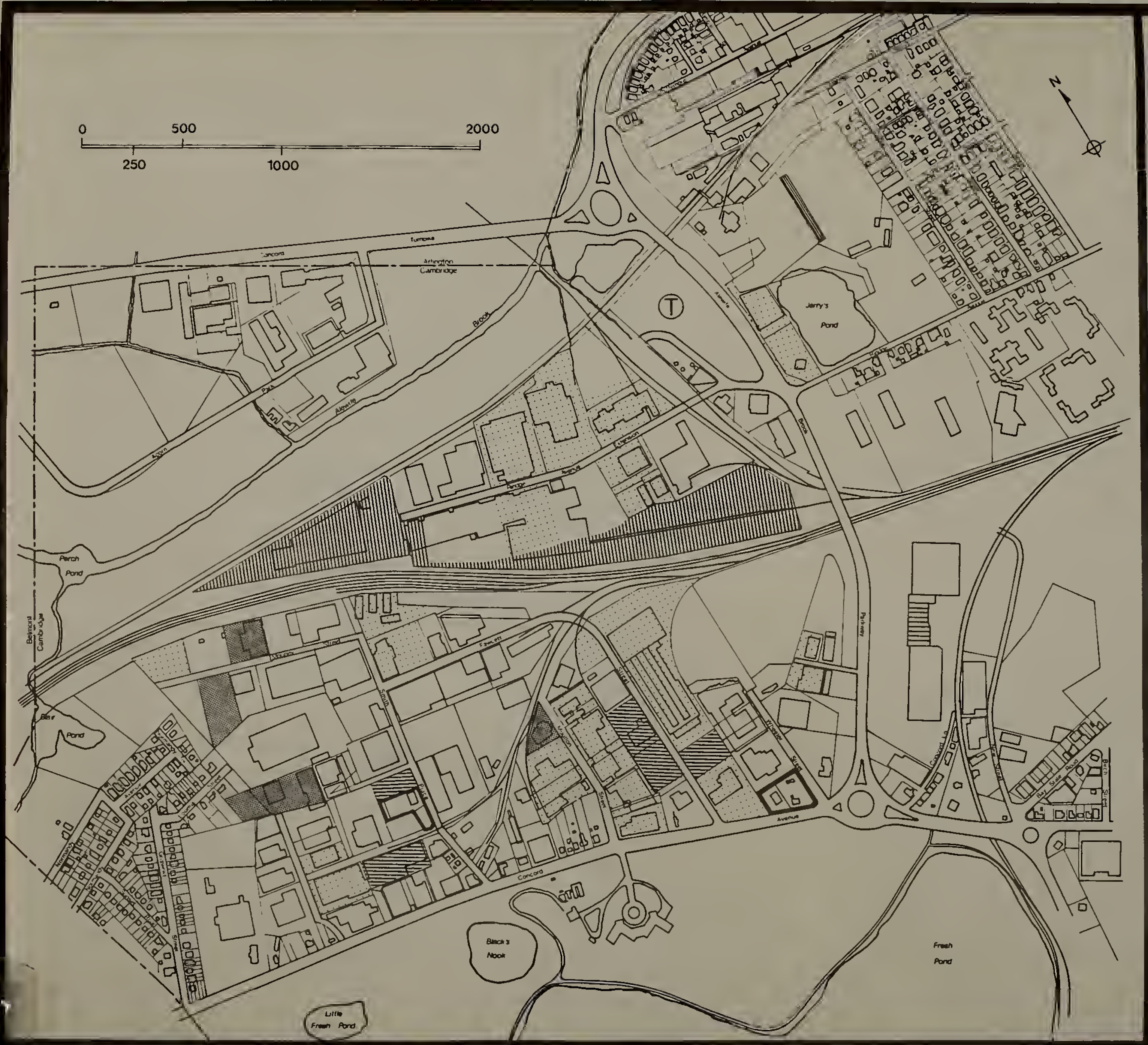
Long before the coming of the Red Line, the Alewife area was a major transportation crossroads for the movement of goods and people. Because of its advantageous location, the area became a major center for those involved in the moving and storage of goods. By 1978, when the city of Cambridge undertook a major city-wide land use survey, warehousing, storage and wholesaling represented the primary use of one-fifth of the land in the Alewife area, making it far and away the predominant active use.

The two principal features which divide the Alewife area are the MDC Alewife Reservation, which follows the course of the Little River, and the West Cambridge Freight Yards, along the B&M Fitchburg Main Line. The Freight Yards separate the two major industrial areas at Alewife, the Triangle and the Quadrangle. The Industrial Triangle is located north of the freight yards and is bounded by the Reservation to the north and the Alewife Brook Parkway on the east. In 1978, the Triangle was dominated by the West End Iron Works, a major manufacturing facility engaged in iron and steel fabrication, which covered an approximately 650,000 square foot parcel. The Quadrangle lies south of the freight yard, with the Alewife

Brook Parkway along the east, Concord Avenue on the south, and a residential neighborhood, known as Strawberry Hill, on the west. In 1978, the Parkway and Concord Avenue were lined with small retail and service businesses. Inside the Quadrangle, a number of narrow streets, most of them private ways, serviced a large number of older industrial buildings. The area's main use was warehousing, storage and wholesaling, with some manufacturing as well. The largest facilities were the Continental Can building on Fawcett Street, the A.O. Wilson building on Smith Place, and the Adley Trucking Terminal, adjacent to the Strawberry Hill neighborhood. Across Alewife Brook Parkway from the Quadrangle is the Fresh Pond Shopping Center and a number of other small businesses along the Parkway, behind the shopping center, and along New Street and Concord Lane.

Moving north on the Alewife Brook Parkway, opposite the Dewey and Almy Circle, we come to large industrial facility of W.R. Grace. West of W.R. Grace, wedged between Route 2 and the Alewife Reservation is the office and R&D complex owned by Arthur D. Little. In 1978, ADL was already the largest employer in the Alewife area.

By the late 1970's, the economic base of the City was fundamentally changing, as the shift away from the traditional industries was well underway. As a number of established businesses in Alewife made plans to close or relocate, large parcels became available for redevelopment. The availability of these parcels attracted the attention of a number of larger developers. In the last eight years, over 1 million square feet of new or substantially rehabilitated office development has been constructed in the Alewife area. Other properties have changed uses without major



Red Line Extension
Land Use Study

Alewife Station Area Land Use Changes 1978-1986

alterations. As shown in Table 3.1, industrial use has declined from 36% to 23% of all land area, while office use has increased from 9% to 17% of all land area. This is by far the most dramatic shift in land use among the areas surrounding the three new stations.

In 1967, the city of Cambridge took a survey which determined the number of jobs per acre of land in the Alewife area. Using this technique, it is possible to estimate the number of additional jobs which have been generated by the shift in land uses. These results are shown in Table 3.2. Office use, according to the survey, produced a total of 92.6 jobs per acre, compared with 19.4 for heavy industry, and 6.2 for light industry. Applying these factors, a conservative estimate of 2000 additional jobs may have been generated by the change in uses. This is a conservative number because the density of the new structures is greater than those in existence in 1976. Table 3.2 applies these factors to the

Table 3.1

ALEWIFE STATION AREA LAND USES
(Percent)

	1978	1986	Projected
Group and Transient Residential	1.1	1.1	1.1
Industrial	36.2	22.8	16.9
Transportation, Utilities, Communication	9.3	9.3	9.3
Consumer Goods and Services	12.5	11.6	11.6
Office Structures	8.9	17.0	25.7
Institutional and Government	1.8	1.8	1.8
Open Space, Developed and Undeveloped	29.5	34.1	31.4

Source: 1978 Cambridge Land Use Survey.

Table 3.2

ESTIMATED JOBS PER ACRE OF LAND USE
ALEWIFE STATION AREA

Land Use	Jobs/Acre	1978	1986	Projected
Manufacturing	19.4	351	177	60
Warehouse/Storage/ Wholesaling	8.4	519	374	318
Services	42.9	924	848	848
Retail	23.9	355	355	355
Office/R&D	92.6	2,531	4,920	7,270
TOTAL		4,680	6,674	8,851

Source: "Alewife Revitalization," Cambridge Planning Department, 1979.

most important of the land uses in the Alewife area in 1978 and 1986.

If the availability of large parcels of land, the area's excellent location in general, and the shift in the local economy were the principal causes of the Alewife development, the Red Line was nevertheless a very important factor for a number of reasons:

1. The planning for the Red Line construction, which was at times turbulent, stimulated a major Alewife planning review on the part of the city of Cambridge to encourage and control its future development;

2. The Red Line construction at Alewife contributed to the overall public improvement of the area; and,

3. The extension of the mass transit service became an important selling point for new high-tech oriented development, allowing the area to compete more successfully with other areas of the city already benefiting from that service.

In cooperation with the planning of the Red Line by the MBTA, the city of Cambridge in 1977 began the Alewife Urban Design Study. Its purpose was to develop a comprehensive Urban Design Plan to determine needed public improvements to streets, sewers and other infrastructure, to preserve and protect open space, and to propose new zoning and land use controls and design guidelines to mold future development and protect nearby residential neighborhoods. By April 1979, the Alewife Revitalization study was published by the Cambridge Community Development Department. As a result of the study effort, the City Council passed a rezoning ordinance for the Alewife area in 1980. Prior to the rezoning, most of the area had been zoned for either light or heavy industry, which provided little control over the scope of future development. The rezoning designated much of the area for office use or for offices with a Planned Unit Development overlay. Though the intensity of use was theoretically lowered, it was felt that the effect would be to encourage development by guaranteeing that future developments would be compatible both in use and scale.

The City Manager, James Sullivan, clearly saw the rezoning as a major impetus for Alewife redevelopment. In his 1980 annual report to the City Council, he stated:

> The City Council's passage of the Alewife rezoning ordinance paves the

> way for realizing the maximum potential of this presently under-utilized area. The rezoning opens up for development the largest under-utilized area in the City of approximately 400 acres, the potential of which can stabilize the tax base for years to come."[6]

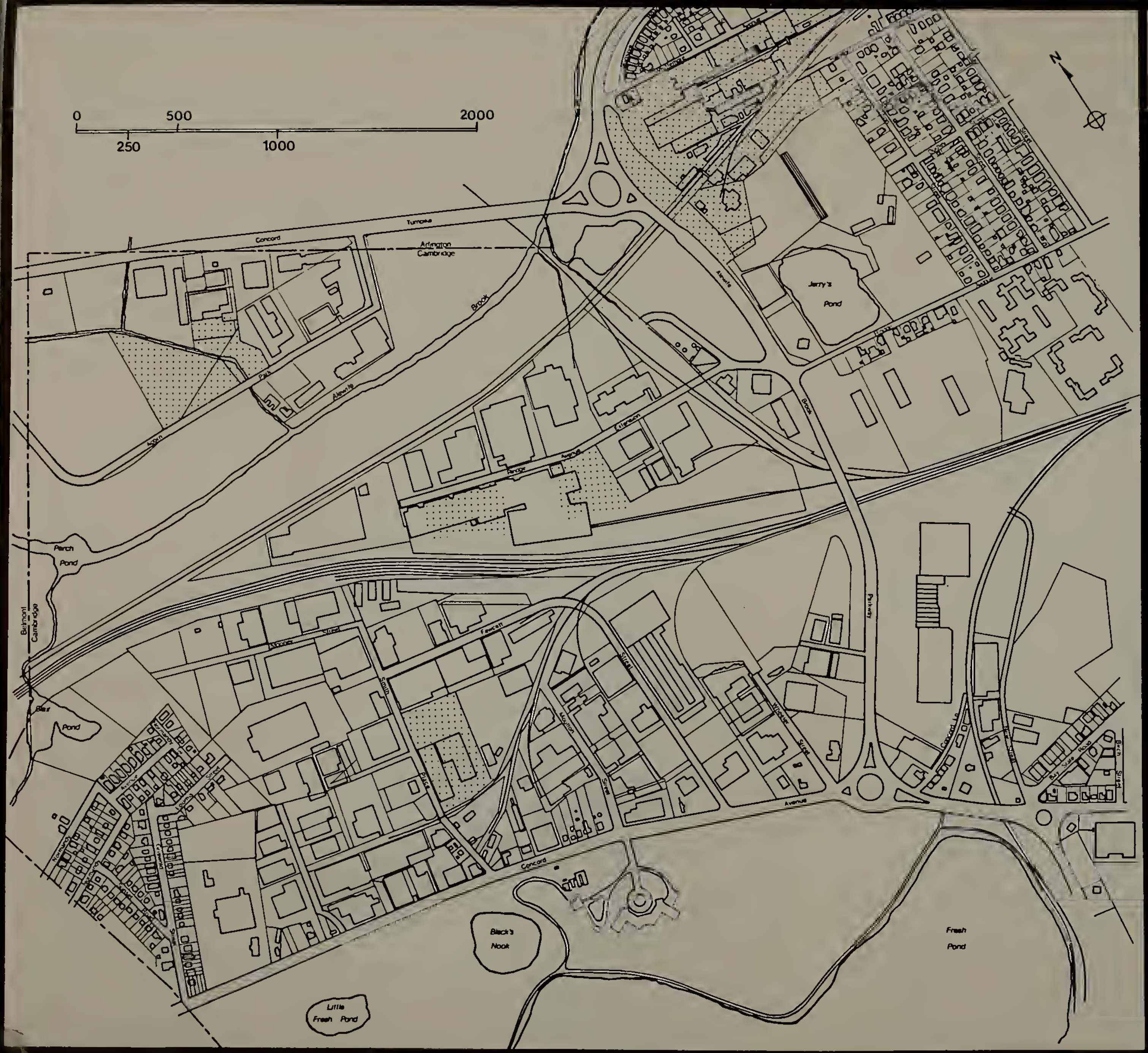
Following the rezoning, the city applied for and received a $2.7 million grant from the Economic Development Administration for sewer and roadway improvements in the area.

Seven major developments have been completed since the opening of the Alewife station. These include:

1.	Cambridgepark I (1) Cambridgepark Drive	Spaulding and Slye	office	185,000 sf
2.	Cambridgepark I (2) Cambridgepark Drive	Spaulding and Slye	office	250,000 sf
3.	725 Concord Avenue	Najarian and Jones	office	80,000 sf
4.	Continental Can Rehab Fawcett Street	Bolt, Beranek and Newman	office/ R&D	125,000 sf
5.	Fresh Pond Square 617 Concord Avenue	Fantasia, Codman	office/ retail	130,900 sf
6.	Genetics Institute Cambridgepark Drive	Genetics Institute	office/ R&D	100,000 sf
7.	One Alewife Place Cambridgepark Drive	Schochet Associates	office	136,000 sf
	TOTAL			1,006,900 sf

In addition to these, another six major projects have been proposed and are in various stages of the development process. These include:

1.	Alewife Center I Alewife Brook Pkwy	Hines Industrial/ W.R. Grace	office/ R&D	88,000 sf
2.	Alewife Center (later phases)	Hines Industrial/ W.R. Grace	mixed use	812,000 sf



- ▩ Industrial
- ☐ Transportation, Utilities
- ⬚ Offices
- ▤ Developed Open Space
- ▥ Undeveloped Land
- ▣ Consumer Goods and Services

Red Line Extension Land Use Study

Alewife Station Area Proposed Land Use Changes

MAPC

3. A.O. Wilson Site Smith Place	A.O. Wilson	office	500,000 sf
4. Arthur D. Little Acorn Park	Arthur D. Little	office	200,000 sf
5. Cambridgepark I (3) Cambridgepark Drive	Spaulding and Slye	office	237,000 sf
6. Cambridgepark II Cambridgepark Drive	Spaulding and Slye	office/ R&D/ hotel	300,000 sf
TOTAL			2,137,000 sf

Note that about half of the new and proposed development has occurred along Cambridgepark Drive, the former Ringe Avenue extension and the main road into the Industrial Triangle. This is the area immediately adjacent to the new station, and the area which has benefited the most from the new public improvements. Since 1978, approximately three-quarters of the Triangle has been cleared for redevelopment. The most ambitious effort has been undertaken by Spaulding and Slye, which purchased and demolished the Iron Works facility, and is now halfway through the development of a major office complex. These projects listed above actually account for only about one-quarter of the land area which has changed uses since 1978. The remainder of the use changes represent properties which have been demolished and are now vacant, or existing structures which have changed uses without undergoing major repairs.

By all accounts, land values over the last ten years have escalated tremendously in the area. In 1980, according to Joseph Kellogg of the Cambridge Planning Department, when Spaulding and Slye purchased the Iron Works property, the company reportedly paid approximately $13.00 per square foot. A nearby parcel recently sold for $60 per square foot.

Table 3.3

OFFICE DEVELOPMENT AND VACANCY
CAMBRIDGE 1984-1986

	1984 Q4	1985 Q3	1986 Q4
Alewife/Route 2	666,240 s.f.	853,160 s.f.	1,217,312 s.f.
% vacant	7.0	19.4	26.4
Harvard Square/ Mass. Ave.	1,031,922 s.f.	1,189,185 s.f.	1,332,424 s.f.
% vacant	16.2	13.7	19.8
Kendall Square/ MIT	2,416,333 s.f.	3,293,333 s.f.	3,704,333 s.f.
% vacant	2.9	10.1	10.3
Total Cambridge	4,114,495 s.f.	5,335,678 s.f.	6,254,069 s.f.
% vacant	6.9	12.4	15.4

Source: The Boston Area Report, Spaulding and Slye.

Most of the space in the new developments is currently renting at from $20.00 to $25.00 per square foot. Vacancy rates are high, however, and have been increasing over the last two years. Spaulding and Slye estimated that completed first-class office space around Alewife (which includes several of the Porter Square developments) was approximately 26% vacant as of the fourth quarter of 1986 (see Table 3.3). This is somewhat higher than the other two major developing areas in Cambridge or the City as a whole and calls into question whether the Alewife area can absorb the additional proposed space anytime soon.

The land use shift at Alewife, and the scale of new development, has of course been matched and exceeded by other areas of the City, including Kendall Square, Lechmere, and the Harvard Square-Massachusetts Avenue corridor from Harvard to Putnam Street. The question is not whether Alewife is unique in its development. It clearly is not. Rather, the question is whether the Alewife area, without the Red Line, would have shared in that development. There is not general agreement among public officials and real estate professionals about the area's redevelopment. If there is a single opinion around which there is a consensus, it is that the redevelopment of Alewife was substantially accelerated by the coming of the Red Line.

B. Porter Square:

It is about a one mile drive from Harvard Square along Massachusetts Avenue to Porter Square. Once there, the new Porter Square MBTA station and its wind sculpture stand prominently at the intersection of Massachusetts and Somerville Avenues. But, before you get there, you must pass by the former Sears building.

Sears, Roebuck and Co. had been a fixture in Porter Square for many years, and had developed a large and successful market which stretched throughout Cambridge and the surrounding communities. Its success was so great that it was said to have the highest gross sales per square foot of any of the company's stores in the Boston area. One of the features which made it successful was its location along Massachusetts Avenue (Route 3A), a major north-south artery between Cambridge and Arlington, well served by various bus and electric trolley routes. The other feature, perhaps more important, was its ample parking, spread over three separate lots, one behind the building and two on the opposite side of Massachusetts Avenue. The store was such a permanent part of Porter Square that few realized that the company actually leased the space, rather than owned it.

The substantial parking and the construction of the Porter Square transit station made the Sears parcel attractive to other uses, and in 1983, a proposal was put forth by Cambridge Development and Investment Associates to convert the building into a 190,000 square foot mixed use development, combining retail, office, restaurant, and cinema space. The project was to be known as the Porter Exchange. The developer had few problems obtaining lease commitments from several "upscale" retail and restaurant tenants.

To some in the community, the conversion and reuse of the Sears Building came to symbolize the "gentrification" of Porter Square and North Cambridge, with the replacement of the practical Sears retail store with the expensive restaurants, retail stores, and theatres planned for Porter Exchange. To others it represented progress, the continuation of a trend based upon demographic change which had begun in Harvard Square more than a decade earlier, as more profitable uses serving a younger, more affluent clientele found that Cambridge is the place to do business. Some older businesses, though perhaps doing well, have found themselves unable to compete for their traditional space.

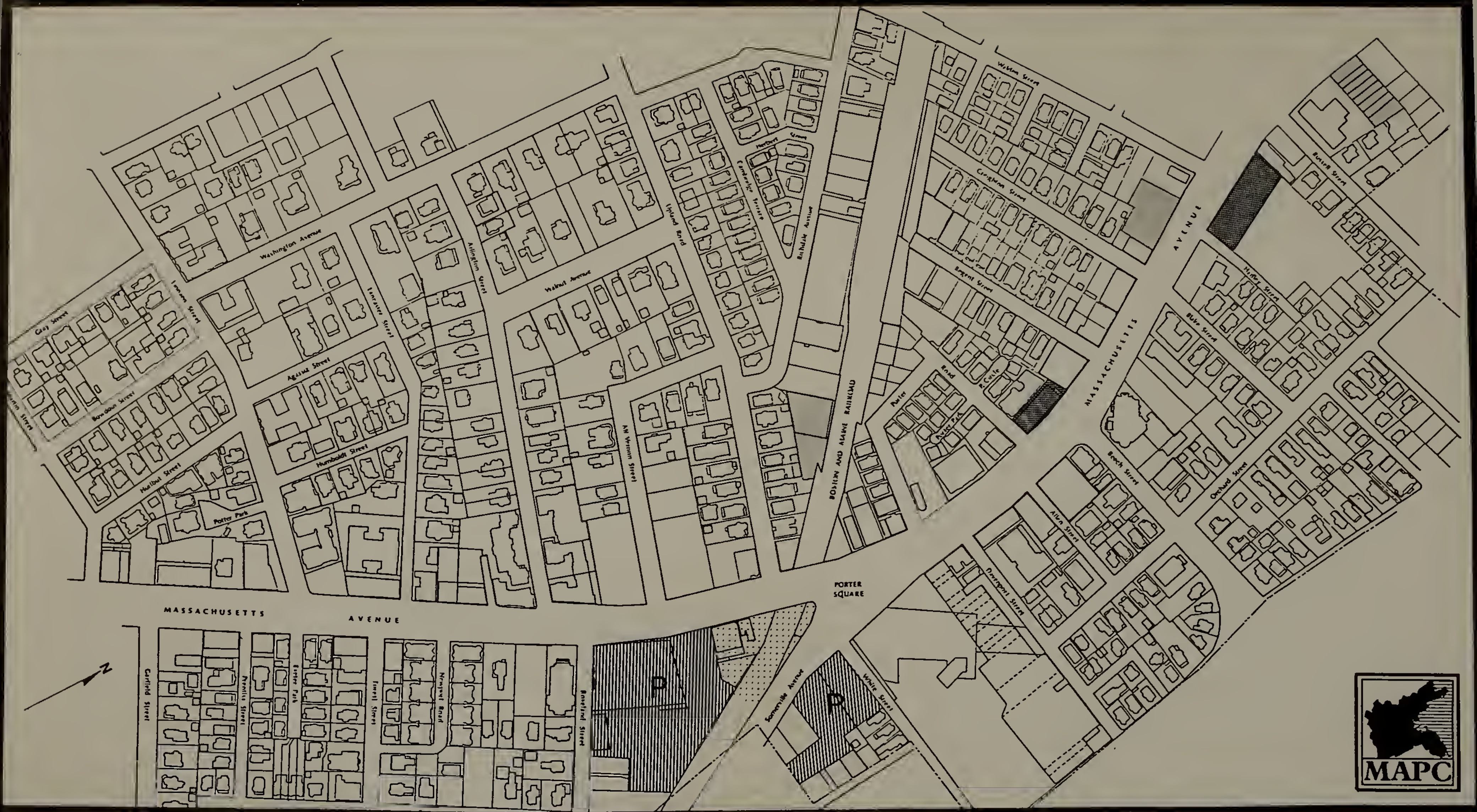
Harvard Square, in the words of one broker interviewed for this study, is "ground zero" in Cambridge in terms of retail and office space. Retail rents in Harvard Square are between $35 and $60 per square foot and even higher for some of the smaller spaces. As one moves north along Massachusetts Avenue, rents reportedly drop by approximately $2 per square foot per block. In Porter Square and above, rents are now approximately $16 to $25 per square foot of ground floor retail space.

The Red Line has clearly brought Porter Square closer to Harvard in the perception of many. One local property owner, for example, related that in 1983 his purchase of a mixed use, retail and apartment building a block north of the new station was in anticipation of the opening of the Red Line extension. At the time, the combined income from the retail spaces on the first floor and the rent-controlled apartments above could not carry the costs of financing and operating the building. The retail spaces were renovated, however, and according to the owner, subsequent increases in income from the retail space have put the building well into the black.

The area chosen for the Porter Square land use study runs along Massachusetts Avenue from Garfield and Martin Streets on the south to Walden Street on the north. The area is approximately one block deep on either side of Massachusetts Avenue, including a long block along Richdale Avenue which abuts the Boston and Maine Railroad Right of Way northwest of the Square.

In 1978, commercial structures, mostly retail, and mixed use (housing and commercial) lined Massachusetts Avenue on both sides in the study area, with residential structures dominating the blocks behind. Older industrial buildings, generally warehousing and storage with some manufacturing, could be found along the railroad, on Richdale Avenue at the southern edge of the right of way and at the ends of Porter Road, Regent Street, and Creighton Road on the northern boundary. The Sears Building and the Porter Square Shopping Center were the most visible commercial developments defining the Square.

Between 1978 and 1986, actual shifts in land uses in the Porter Square area have been modest. Small increases in residential and office use have been offset by similar declines in industrial and retail use (see Table 3.4). Even with the proposed development, Porter Square will still be



Red Line Extension Land Use Study
Porter Square Area Land Use Changes

0 125 250 500 1000 1500

▒ Transportation

▨ Residential

■ Office

▥ Office/Retail

P = Proposed

Table 3.4

PORTER SQUARE STATION AREA LAND USES
(Percent)

	1978	1986	Projected*
Residential	53.5	55.6	55.6
with Retail	2.3	2.3	2.3
with Office	1.0	1.0	1.0
Group and Transient Residential	1.9	1.9	1.9
Industrial	6.7	5.8	5.8
Manufacturing and Processing	1.5	1.5	1.5
Warehousing, Storage, and Wholesaling	4.0	3.0	3.0
Transportation, Utilities, Communication	.2	.6	.6
Consumer Goods and Services	23.2	20.1	18.7
Office Structures	1.1	3.2	5.9
Institutional and Government	3.1	3.1	3.1
Open Space, Developed and Undeveloped	10.2	9.7	8.4

* based upon major developments proposed.
Source: 1978 Cambridge Land Use Survey, MAPC windshield survey.

Table 3.5

NEW PORTER SQUARE DEVELOPMENT

1. 1972 Massachusetts Ave.	Raymond Bandar	office	15,000 sf
2. Henderson Carriage House 2071 Massachusetts Ave.	H.J. Davis Dev.	office/ retail	100,000 sf
3. 2050 Massachusetts Ave.	Cambridge Housing Authority	elderly housing	51 units
4. 2145 Massachusetts Ave.		housing	8 units
5. 1-11 Richdale Ave.		housing	11 units

overwhelmingly a residential and retail area.

Most of the shifts in land uses which have occurred are the result of three housing and two commercial developments during the interim. These new developments are shown in Table 3.5. Perhaps the most dramatic of the projects above has been the Henderson Carriage House, located at 2071 Massachusetts Avenue, about four blocks north of the Porter Square Station. The five story brick building was most recently used to house an automobile dealership, but had stood empty since the late 1970's. At least one previous attempt to redevelop the parcel proved unsuccessful. The 100,000 square foot building was finally developed by H.J. Davis, and opened in the fall of 1983, with retail space on the first floor and office space above. Among the first floor clients are a bank, restaurant, real estate agency, a custom picture framing shop and a shop which sells window furnishings. Behind the building is a 150 space parking lot.

According to the developer, the Red Line Extension did help generate interest in the property, though it was not the most important factor. Rather, the need for affordable office space within Cambridge, with adequate parking, made the project attractive. With rents at approximately $14.00 per square foot, the Carriage House is significantly less expensive than most of the comparable locations around the Kendall, Harvard and Alewife MBTA stations. The office tenants in the Carriage House are typical of the engineering and consulting operations that are attracted to Cambridge locations.

The city of Cambridge created a development plan for Porter Square in preparation for the construction of the MBTA station. Unlike the Alewife plans, these were aimed at preserving the neighborhood surrounding the new station, discouraging a more intensive use of existing land.

With encouragement from local neighborhood organizations, the City Council essentially down-zoned the commercial areas along Massachusetts Avenue, in effect reducing the allowed Floor Area Ratio (FAR) from 4 to 2. The city, again with neighborhood encouragement, also chose not to renew the designation of Porter Square as a Commercial Area Revitalization District (CARD), thereby making the commercial development projects ineligible for Industrial Revenue Bond financing through the Massachusetts Industrial Finance Agency.

Neighborhood input also influenced the design of the station itself by ensuring early on that no commuter parking structure be constructed at the Porter Station in order to minimize additional automobile traffic in the area.

The extent of influence which the T has had upon existing businesses appears to be mixed. The restaurants, coffee shops and convenience stores within sight of the station generally report an increase in business since the opening of the station. Bob Slate's Stationers also reports a significant increase, although the new office development around North Cambridge and Alewife may have contributed. Other retail businesses, particularly those dealing in shoppers' goods, report no recognizable change. When asked what the most important effect of the Red Line

Table 3.6

POINT OF ORIGIN BY STATION
(People who walked to the station)

Origin	Alewife	Davis	Porter	Harvard
Home	443 (57%)	2,586 (76%)	2,669 (91%)	2,561 (32%)
Non-Home	338 (43%)	438 (14%)	275 (9%)	5,514 (68%)
Work	270	199	133	3,323
School	5	166	38	1,329
Shopping	33	11	34	557
Other	30	62	70	305

Source: Central Transportation Planning Staff (CTPS)

NOTE: This survey polled weekday riders. One would expect weekday shopping trips to be limited. Unfortunately, weekend data is not available. Also, some of those who cited other points of origin probably shopped as well prior to the commuting trip.

Extension has been, one proprietor answered, "it's easier for me to get downtown to get my hair done."

A recent survey of weekday riders who boarded at the Porter Square station tends to support this premise. Of those riders, less than 1% cited their reason for using the Porter station as shopping in the neighborhood. The vast majority had departed from their nearby homes.

Two significant projects have been proposed for Porter Square. These are:

1. Porter Exchange, a 190,000 square foot retail and office development, on the site of the former Sears Building, and,

2. The Porter Square Atrium, an 80,000 square foot retail development on Somerville Avenue across from the T station, on the site of the former Porter Square Dodge.

The Porter Exchange proposal was discussed at length at the beginning of this section. The Atrium will be similar in concept to the Exchange, including both retail, and restaurant space. Both the Porter Exchange and the Atrium were originally planned with a significant amount of cinema space, but community opposition forced the removal of the theatre space from the plans. Ironically, the cinema space was the feature perhaps most suited to exploit the Red Line. A survey by the developer of Porter Exchange showed that 20% of the patrons of a comparable theatre in nearby Harvard Square had come by MBTA. Though bold in design, neither the Exchange nor the Atrium will significantly change land use patterns in Porter Square. Whether they represent "gentrification" is a judgement clearly beyond the scope of this study.

CHAPTER 4

SOMERVILLE

The First National Corporation's processing, warehousing and distribution facility in East Somerville was one of the city's major employers. When it announced that it was closing down its operations there in the mid-1970's, it was a serious blow to the local economy. The decision was but one part of a larger regional corporate strategy. The company had found itself holding a large number of older stores throughout New England, usually located in traditional commercial centers. The stores in such locations were small, parking was often inadequate and access was difficult. First National found itself unable to compete successfully with other larger, modern supermarkets located in highway-oriented shopping centers. The company decided that it would be easier to divest a large part of its New England operations rather than attempt to revitalize its older facilities, a decision which had repercussions in older neighborhoods and commercial centers throughout the Boston area. It became a symbol of the problem challenging Somerville and many of the region's other older urban communities in the 1970's- how to revitalize an aging economic base.

Today, as one approaches the East Somerville site from a distance, the old First National water tower is now a dramatic signpost announcing the Assembly Square Mall, the innovative commercial development which is the cornerstone of the city's economic revitalization effort. In cooperation with a private developer, city officials assembled the land and provided critical infrastructure and other project support through a federal Urban Development Action Grant. Capitalizing on the site's favorable location at the junction of Interstate 93 and Route 28, the development includes a modern multi-screen cinema, office space, and an enclosed shopping mall, the last developed by creatively reusing the main building of the former industrial complex. The Assembly Square development is a dramatic example of what can be accomplished through public/private partnerships. It also demonstrates how traditional industrial jobs are being replaced in the region's older communities by expansion in the service and trade sectors.

Between 1970 and 1980, the City of Somerville was not faring well in this transition, losing over 2,000 jobs, a decline of about 29%. Most of the losses were in manufacturing and wholesale and retail trade. At the same time, the City saw a net gain of only 2.4% in the number of occupied housing units. This was not enough to offset a significant drop in average household size, causing a 13% drop in population from 89,000 to 77,000. The rate of decline was more than twice that experienced by the Boston Standard Metropolitan Statistical Area (SMSA).

By 1984, however, Somerville had regained much of the employment lost by 1980 as municipal efforts to attract new businesses and expand its commercial centers have taken advantage of the stronger regional economy. Most of the employment gains have been in the service and trade sectors and the population decline has slowed to about half the previous rate.

A. Davis Square:

Almost everyone with memories of the Davis Square of fifteen years ago is struck by the remarkable difference in the appearance of Davis Square today. A thriving commercial center through the 1950's, during the late 1960's and early 1970's Davis Square began to experience the decline typical of many older commercial centers. Between 1967 and 1977, according to the U.S. Census of Retail Trade, the total number of retail stores in Davis Square declined by over 10%. A planning study completed for the city in 1980 found that:

> During the last fifteen years, Davis Square has experienced decline as more modern and convenient facilities have been better able to meet the needs of the Davis Square trade area... Like most older downtown centers, Davis Square has not succeeded in keeping pace with changing trade area needs or perceptions. Continued losses, combined with a shifting trade area, a lack of competitiveness among merchants, and problems including traffic congestion, inadequate parking, and deteriorating appearance have contributed to the decline of Davis Square.[7]

The proposal to bring the Red Line Extension through Davis Square was the stimulus for a thorough city-sponsored plan for the revitalization of Davis Square. In 1977, The Somerville Office of Planning and Community Development (OPCD) and the MAPC produced the first Davis Square urban design and business study. In the same year, the Davis Square Task Force was formed, comprising neighborhood residents, members of the Davis Square business community and local officials. The Task Force acted as a citizen's advisory committee regarding revitalization plans and policies for the Square.

In 1979, the OPCD commissioned a series of nine working papers using a number of consulting firms, which provided information on land use, the potential office and retail market, traffic and parking and other Davis Square issues. The working papers and the guidance of the Task Force culminated in the adoption of the Davis Square Action Plan in 1982.

Throughout the planning process in Davis Square, the Red Line was seen as the cornerstone of the revitalization effort. From the Action Plan:

> Prospects for Davis Square's future are bright. City officials and local residents are convinced that the downward trend has run its course and that Davis Square is on the verge of a major revitalization.
>
> This renewed optimism results in large part from the MBTA's decision in 1976 to extend the Red Line from its present terminus at Harvard Square to Fresh Pond in Cambridge.[8]

In cooperation, with the Red Line construction, the city of Somerville committed other resources to the revitalization effort. These included:

1. Streetscape improvements along Elm, Highland and Holland streets through a grant from the Federal Highway Administration's Urban Systems Program. This work included street reconstruction, the widening of sidewalks, and new lighting, fences, and plantings.

2. Renovations to Kenney Park at the corner of Grove Street and Highland Avenue. This is the largest and most important public recreation area in Davis Square.

3. Storefront facade improvement grants funded through the city's Community Development Block Grant entitlement. The facade program financed one-half of the costs of eligible exterior improvements, with guidance in design from the Office of Planning and Community Development. Among the recipients of assistance were the Somerville Theatre, the Store 24 Block and the Marks Department Store Block, all of which underwent significant improvement.

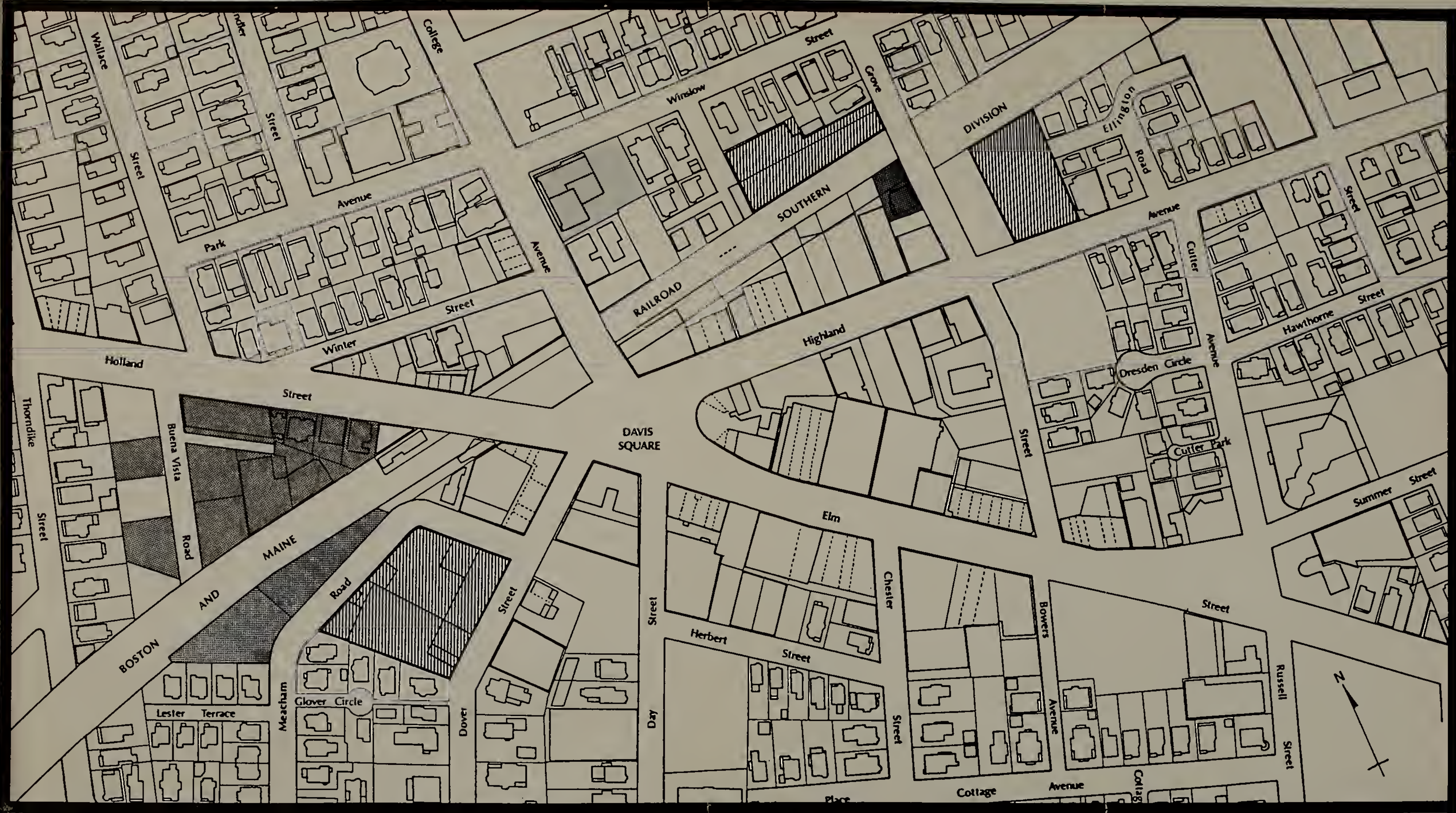
4. Designation of Davis Square as a Commercial Area Revitalization District (CARD) which allowed major commercial developments in the Square to use Industrial Revenue Bond (IRB) financing through the Massachusetts Industrial Finance Agency (MIFA).

   One development has taken advantage of IRB financing. This is the Erico Building, a retail and office property involving the rehabilitation of 6,000 square feet and the construction of 12,000 square feet of new space.

5. The provision of additional public parking on several sites throughout the Square.

6. The construction of the Woodbridge Elderly Housing development on the former site of the Woodbridge Hotel on College Avenue.

7. Site preparation for the Buena Vista development through a $1.7 million Urban Development Action Grant. The $10 million, 100,000



Red Line Extension Land Use Study
Davis Square Area Land Use Changes

square foot office and retail development is expected to bring 500 new jobs to Davis Square. Included on the site will be a $2 million public parking garage.

Several other developments have been undertaken through private initiative in Davis Square, including:

1. The Bryor Clothing Building on Grove Street, a former industrial building renovated into 17,000 square feet of office space.

2. The reuse of the former New England Telephone Building, now a 15,000 square foot Super Osco Drug Store after a $1 million purchase and rehabilitation.

3. The renovation of the former Marks Department Store to provide office space for the Social Security Administration.

A study of land use changes in Davis Square underscores the revitalization effort and the principal goal of strengthening the Square as a viable neighborhood and community service shopping center. The Table 4.1 compares current land use with those measured by the Davis Square Planning Study in 1980. The most dramatic increase has been the amount of land use devoted to parking, due principally to the additional public parking provided by the city of Somerville and the MBTA. In the 1980 market analysis, the need for additional parking had been the primary concern in surveys of both merchants and shoppers, as it is in virtually every older commercial center.

Table 4.1

DAVIS SQUARE LAND USE CHANGES
1980-1986
(Percent)

	1980	1986
Residential	38.5	39.4
Commercial	24.8	27.4
Vacant	7.6	4.5
Parking	8.1	13.6
Open Space/Recreation	7.0	8.5
Manufacturing	3.5	0.0
Transportation/Utilities	7.5	6.0
Light Industrial	2.8	0.6

Source: Davis Square Planning Study: Land Use, 1980, and MAPC field survey, November, 1986.

As seen in Table 4.1, commercial use is the predominant non-residential use in Davis Square and has increased by approximately 10% between 1980 and 1986. Since the 1980 study provided no further breakdown of commercial land use, it was not possible to identify shifts in land use within the various commercial sub-categories, namely office, retail and personal services. Other evidence suggests, however, that these shifts may have been significant.

Table 4.2 compares the number and mix of retail stores in Davis Square between 1977 and 1987. Note that the number of retail stores in the area has continued the decline of previous decades, in this case from 68 in 1977 to 56 in 1987. While some of this may represent the loss or consolidation of retail space, more likely the spaces were filled instead by personal service and office use. A breakdown of these non-retail spaces shows a predominance of beauticians and barbers, and insurance,

Table 4.2

NUMBER OF RETAIL ESTABLISHMENTS BY TYPE
DAVIS SQUARE
(1977-1987)

	1977	1987
Building materials, hardware, garden supply	2	0
General merchandise group stores	3	1
Food stores	9	5
Gasoline service stations	1	2
Apparel and accessory stores	7	5
Furniture, home furnishings, and equipment stores	5	7
Eating and drinking places	19	16
Drug and proprietary stores	6	1
Miscellaneous retail stores	11	15
TOTAL	68	53

Source: The Census of Retail Trade, Major Retail Centers, 1977. This was the last year in which Davis Square was included in the report. The 1987 count was obtained through a field survey by MAPC staff in January, 1987.

real estate, law, and medical offices.

As with Porter Square, some businesses have experienced an increase in sales, particularly those near to the station, while others have not. The proprietor of the McDonald's located on Elm Street about a block from the station also owns the McDonalds in the Porter Square Shopping Center. The Porter Square store which is directly opposite the new station has seen a 15% increase in business above anticipated levels. He attributes this to the Red Line. The Davis Square store, however, has seen no increase in customers.

Table 4.3

SURVEY OF RENTS AND VACANCIES, 1986
(DOLLARS PER SQUARE FOOT)

	Mean Rents	Vacancies (percent)
Davis Square	7.63	11.0
Teele Square	6.13	14.3
MaGoun Square	6.57	16.1
Union Square	6.70	12.7

While the visual impact of revitalization upon Davis Square has been significant, the underlying economic health of Davis Square appears to be improving at a more modest rate. To show this, four commercial centers in Somerville were studied, including Davis Square, for the current commercial rents and vacancy rates. Rent levels were obtained from the Somerville Board of Assessors, and a count of vacant storefronts was obtained from a field survey by MAPC staff. Table 4.3 presents the results of the study. Of the four commercial areas, Davis Square has the highest rents and the lowest percent of vacancies, but not dramatically so. Many of the Davis Square vacancies, however, were in buildings undergoing renovation. The Somerville OPCD reports that commercial rents in Davis Square are now running between $12 and $13 per square foot.

Davis Square appears to have passed the turning point on its way to recovery. Businesses in the Square, old and new alike, are generally thriving and public confidence is high. The Red Line clearly helped to stimulate this revitalization, but it was clearly accomplished only by a cooperative effort of the municipality, local merchants and the residents of Davis Square.

CHAPTER 5

HOUSING PRICES AND DEMOGRAPHIC CHANGE

He was a federal employee for three decades, and the time had come to retire. He and his wife had decided, after some thought, to sell their home in North Cambridge and move to a condominium on the Cape. But even Thomas P. O'Neill III, Congressman from the 8th District and Speaker of the House of Representatives, was reportedly surprised to find his home on Russell Street sell for the price that it did, an astonishing $374,000.

Between 1983 and 1986, single family housing prices in the Boston area increased by 60%. However, this unprecendented rate was actually exceeded in the three communities with residential areas near the three new Red Line stations- Cambridge, Somerville, and Arlington. In this section, residential prices are reviewed to determine if prices in the impact areas followed the community-wide trends, or increased slower or faster than those of the community in which the neighborhoods were located.

If the Red Line Extension has already had a measurable impact upon residential values, one would expect prices in the areas around the stations to be increasing at a faster rate than the cities as a whole. This did in fact occur in two areas, the Cambridge neighborhood near Alewife, and the Somerville neighborhood near Porter. It did not occur in the other impact areas where prices rose at approximately the same rate, or more slowly, than those of the cities in which they were located. The two areas where prices did increase at a faster rate happened also to be those areas with the least expensive prices in the base year.

Table 5.1 compares the price of one-, two- and three-family homes in the neighborhoods surrounding the new Red Line Stations in 1980, before the stations opened, and in 1985 once the stations were in operation. Note that in Cambridge the figures for 1980 were unavailable, so 1981 numbers were used instead. As stated above, the Cambridge neighborhood near Alewife and the areas of Somerville near the Porter Square station clearly stand out as growing in value at a rate significantly higher than the rest of the communities. Three of the remaining areas- Arlington near the Alewife station, the Somerville communities near Davis Square and the Cambridge neighborhood in the northern portion of Porter Square- have each appreciated in value at a rate roughly equal to the rest of the city in which they are located. In the Porter Square area south of Upland road in Cambridge, the sales price rose considerably less as this area had high median prices to begin with in 1981.

Table 5.1

MEDIAN SALES PRICES FOR ONE TO THREE FAMILY HOMES

	1980 (81)	1985	Percent Change
ARLINGTON (2 fam)	$85,226	$193,760	127
Alewife (2 fam)	80,631	188,486	133
CAMBRIDGE	85,000 (81)	179,000	110
Alewife	65,500 (81)	148,000	126
Porter, North	95,000 (81)	184,000	93
Porter, South	200,000 (81)	292,750	46
SOMERVILLE	45,650	138,000	202
Davis	52,000	155,000	198
Porter	46,450	155,000	234

Sources: Arlington Planning Department, Cambridge Board of Assessors, Somerville Board of Assessors.

If by 1985 the Red Line Extension had demonstrated a significant effect on on local housing markets, then some sign of a major shift in housing values should be visible in the neighborhoods in the immediate vicinity of the new stations. Whether the Red Line is considered by homebuyers as a benefit in terms of transportation time and cost is not yet clear. Either homebuyers are not factoring in the Red Line to any great extent (the opinion of several brokers interviewed for this study), or an insufficient amount of time has passed for a noticeable change to have occurred.

CHAPTER 6

DEMOGRAPHIC CHANGE

As transportation officials readied their plans for the Red Line Extension during the 1970's, the two local communities which would feel the most impact, Cambridge and Somerville, were both undergoing some important demographic changes. The neighborhoods surrounding each proposed station were evolving in ways which contributed, but were not always identical to, the changes happening in the larger communities to which they belonged. To understand this demographic and economic context is the goal of the remainder of this section.

Overview

Perhaps the most important long term demographic trend throughout the region, and indeed the nation, has been the continuing decline in the size of the average household. In the Boston area, the average household size dropped from 3.06 to 2.75 persons per household between 1970 and 1980. This trend, even when combined with a 5% drop in the population from 1970 to 1980, led to a 15% increase in the number of households.

The decline in household size reflects a number of demographic trends. According to Dr. Douglas Carnahan, MAPC Demographer:

> Smaller households are not merely shrunken versions of larger ones. Decline in household size accelerated over the 1970s, not only because of the falling birth rate, but because the young are forming their own households earlier, more people are divorcing, separating and postponing or foregoing marriage, and life expectancy is increasing, leaving many elderly people to live alone longer. As a result, sharp changes have occured in the extremes of household size distribution. There has been a large expansion in single-person households, and a large reduction in households containing more than four persons.[9]

The increase in single-person households is evident when you consider that while the total number of households in the region increased from 1970 to 1980, the number and percent of families with children declined, from 40% of all households to 37%. In addition, those families with children had fewer of them. Single person households, in contrast, increased from 20% to 30% of all households.

The population of the region changed in other ways during the 1970's. It was better educated as more persons over the age of 25 had completed at least four years of college by 1980. The population was older and more mobile as the percent of households which had moved into their current units within the last five years increased to 53%.

The regional economy was changing as well. Total employment in the region increased by 29%. Most of that increase was in the service sector, which grew by 156%. The two other major employment sectors, manufacturing and wholesale and retail trade, saw only modest gains over the same period.

Both of the Red Line Extension communities have been effected by these regional trends. Each of the communities has moved in the same general demographic direction as the region, but the degree to which each has done so varies sharply. Because both are essentially older, built communities, each experienced only a fraction of the percentage increase in housing units reflected in the region generally. Though adjacent to one another, the Red Line communities are in many respects as different from each other as they are from the region. A clearer demographic picture of both Cambridge and Somerville begins to emerge when each of the communities is studied in detail. In the remainder of this section, additional population, housing, and economic data will be reviewed for each of the communities and the impact areas around the new stations to better outline the context within which the Red Line Extension and its impacts may be understood.

Table 6.1

POPULATION TRENDS: 1980
ARLINGTON, CAMBRIDGE, AND SOMERVILLE

		Percent	Percent Change 1970-1980
POPULATION			
Boston SMSA	2,763,357		- 4.7
Arlington	48,219		- 9.9
Cambridge	95,322		- 5.0
Somerville	77,372		- 12.8
PERSONS UNDER 18			
Boston SMSA	673,071	23.2	- 23.4
Arlington	9,987	18.7	- 36.0
Cambridge	14,977	14.9	- 25.7
Somerville	16,499	18.6	- 38.3
ELDERLY (65+)			
Boston SMSA	344,744	11.9	11.3
Arlington	8,032	15.0	6.9
Cambridge	10,871	10.8	- 7.0
Somerville	10,495	11.8	- 2.7
OCCUPIED HOUSING UNITS			
Boston SMSA	990,660		15.3
Arlington	18,552		5.2
Cambridge	38,836		6.6
Somerville	29,687		2.3
FAMILES WITH CHILDREN			
Boston SMSA	322,490	37.5	- 7.5
Arlington	5,004	28.4	- 22.0
Cambridge	7,626	20.9	- 12.0
Somerville	8,132	28.0	- 25.5
ONE PERSON HOUSEHOLDS			
Boston SMSA	260,641	30.3	52.4
Arlington	5,064	28.7	57.1
Cambridge	16,329	44.8	38.6
Somerville	8,924	30.8	48.3
RECENT MOVERS			
Boston SMSA		53.2	15.7
Arlington		43.4	4.3
Cambridge		65.1	14.6
Somerville		51.0	12.8

Source: U.S. Bureau of the Census, Census of Population and Housing, General Population Characteristics, 1980.

A. Cambridge:

Within Cambridge, the universities are a uniquely important engine driving the community's economics and demography. Nowhere is this more evident than in Harvard Square, the northern terminus of the MBTA's Red Line until the opening of the Red Line Extension in 1985. When one exits the station, which was totally rebuilt as part of the Red Line Extension Project, the physical presence of Harvard University literally surrounds you. The Holyoke Center, built in 1974, rises above the Square on its southern edge. The entryway to Harvard Yard lies to the Northeast. (When construction of the Red Line Extension began, progress was held up for several months while archeologists scoured the cut under the gate for artifacts from Harvard's past.) The Harvard Cooperative Society dominates the retail block on the opposite side. Students and young people are everywhere, for Harvard Square is still one of the key centers of the youth culture in New England.

In 1980, nearly one-quarter of the total population of the city of Cambridge were college students, up from 19% in 1970. Joining them is a large group of young adults, 25 to 34 years of age, which make up a disproportionate percentage of the one-person households within the community. A major reason for this younger profile is the large predominance of rental housing. In Cambridge, 82% of the occupied housing units were rental, compared to 54% for the region. Thus it is not surprising that mobility is much higher in Cambridge than within the region or the other Extension communities; in 1980, nearly two-thirds of the households had moved into their units within the last five years. In contrast, only 21% of the city's 1980 housing units were occupied by families with children.

By 1980, 44.8% of the Cambridge housing units contained one-person households, while the Boston SMSA and the other two Extension communities hovered around 30%. Though clearly increasing in numbers, one-person households are far from a homogenous group; the young, middle aged, and elderly are all represented. Table 6.2 displays one-person households by age of householder for the SMSA, Cambridge, and Somerville. In 1980, the elderly were still the largest component of one-person households within the SMSA, though less so than in 1970. However, non-elderly one-person households increased over the decade at a faster rate than those among the elderly. Note that while the age profile of one-person households in Somerville very closely parallels that of the region, this is not so in Cambridge, where the 25-34 age group is dominant, with 37.5 percent of all one-person households.

The continuing growth in the City's student population is a reflection of the overall expansion of its two major educational institutions which have had an enormous economic impact. Harvard University and the Massachusetts Institute of Technology have long been the two largest employers in the community. As the two universities evolved into national centers for scientific and technological advancement, they have also guided the direction of the city's economic development.

The shift to a service economy occurring throughout the Boston area was reflected in the occupations of Cambridge residents. In 1950, only 21% of

Table 6.2

ONE-PERSON HOUSEHOLDS

	Boston SMSA		Cambridge		Somerville	
1980:						
Total	260,955		16,367		8,903	
15-24	19,214	(7.3%)	1,344	(8.2%)	705	(7.9%)
25-34	57,984	(22.2%)	6,143	(37.5%)	2,237	(25.1%)
35-44	23,502	(9.0%)	2,056	(12.5%)	855	(9.6%)
45-64	58,849	(22.5%)	2,763	(16.8%)	1,820	(20.4%)
65+	101,406	(38.8%)	4,062	(24.8%)	3,284	(36.8%)
1970:						
Total	171,348		11,804		6,029	
65+	74,147	(43.2%)	3,764	(31.8%)	2,611	(43.3%)

Source: U.S. Census of Population and Housing, Metropolitan Housing Characteristics, 1970 and 1980.

the community's civilian labor force were in professional, technical or managerial positions. By 1980, this amount had increased to 44.4%. Not surprisingly, the shift in occupation is reflected in the level of education: in 1980, 46% of all residents 25 years and over had completed at least four years of college as compared to 27% for the region as a whole.

Still, the economic transformation within Cambridge and the upscale population it apparently has attracted coexists with a long-established working class community. In 1980, the median family income in Cambridge was $17,845, the lowest of the three Extension communities, and 13% of the population was below the poverty level. This is again a reflection of the fact that Cambridge has an extremely high percentage of renter-occupied and subsidized units. About 15% of the housing units in the city are subsidized by a federal or state program, whereas only 5% of the housing units in Somerville, 4% in Arlington, and 4% in the region are subsidized.

The Station Areas Within Cambridge

The Red Line Extension impact areas north of Harvard Square are a microcosm of these demographic forces which are still shaping the future of the city of Cambridge. A measure of the evolution of the neighborhoods surrounding the Red Line stations at Porter Square and Alewife is really a measure of how Cambridge itself is changing.

For purposes of this analysis, we have identified three impact zones around the two Red Line stations located in North Cambridge. These have been labelled: 1) Alewife, 2) Porter, North, and 3) Porter, South. A 1/4 mile radius was drawn around Porter Square, from Ringe Avenue on the north to a point approximately halfway to Harvard Square on the southern edge. This area includes parts of Cambridge and Somerville. The Alewife area was drawn with approximately a 1/2 mile radius around the Alewife Station, and includes a part of South Arlington as well as Cambridge. Most of the Cambridge residential area is to the east and northeast of the station. The Alewife station area has a wider radius because there are few residential units within 1/4 mile.

For this analysis, the Cambridge part of the Porter Square impact zone was further divided into northern and southern sections, with Upland Road, at the southern edge of Porter Square, as the boundary. Upland Road is clearly an important neighborhood border. Immediately south of Upland Road is the Avon Hill area, which is second only to Brattle Street in local prestige as a residential neighborhood. East of Massachusetts Avenue is the Agassiz School District, the residential neighborhood nestled between Massachusetts Avenue and Beacon Street on the Somerville line. With Porter Square at its northern tip and Harvard's museums marking its southern edge, this triangular shaped area is notable for its well-preserved, Victorian-style homes and tree-lined streets. The blocks along Massachusetts Avenue are also dotted with older multi-family masonry apartment buildings, which provide housing for students and other small households.

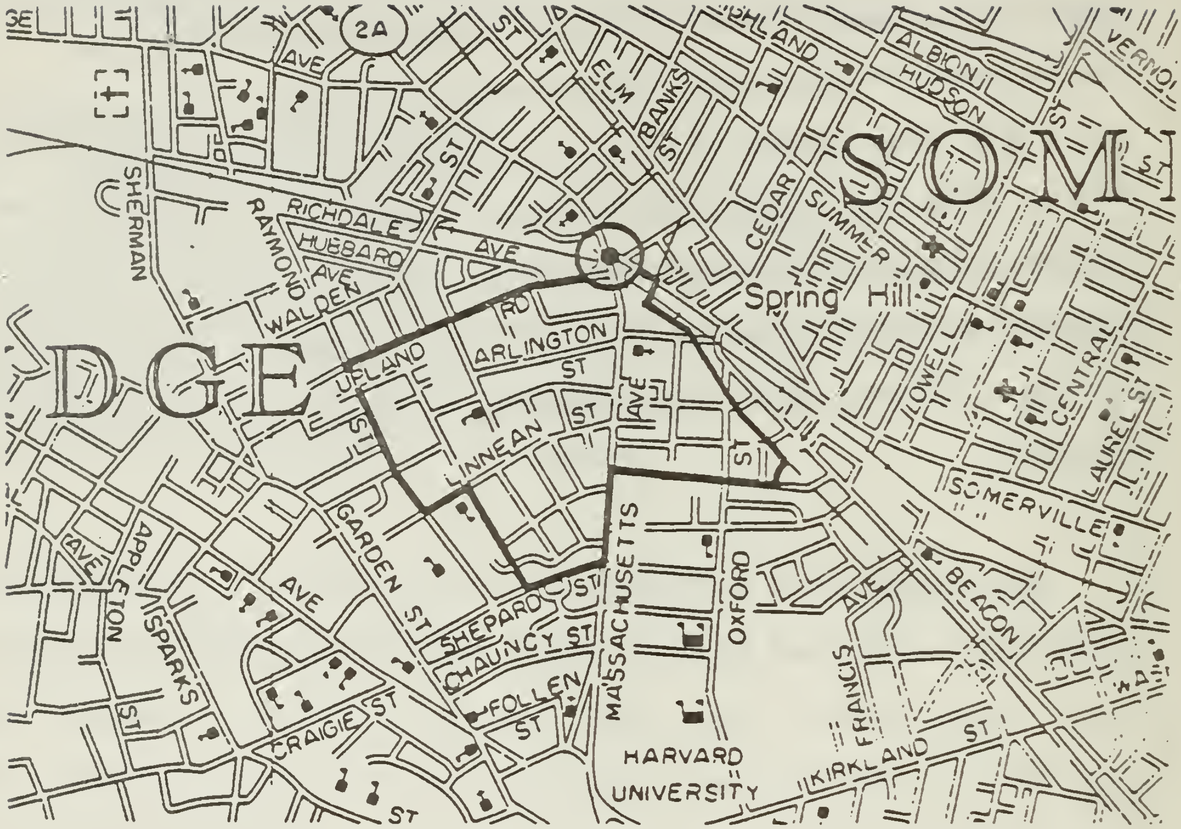


Figure 6.1. PORTER, SOUTH IMPACT AREA

Porter, South

In 1970, the Porter, South area was already established as more affluent than the rest of Cambridge. With a median family income 29% above and a mean single-family home value 57% above that of the city, the area was also much more affluent than the other two impact zones in North Cambridge. Table 6.3 contains income, home value and educational data for all three impact areas. It shows that Porter, South widened those economic differences between 1970 and 1980 for two of the three factors. Both the median family income and mean value of single-family homes increased much faster than that of the city and the other impact zones.

Table 6.3

INCOME, HOME VALUE, AND EDUCATION
1970-1980
CAMBRIDGE RED LINE IMPACT ZONES

	1970	1980	Percent Change
MEDIAN FAMILY INCOME:			
Boston SMSA	$11,449	$22,848	99.6
Cambridge	9,815	17,845	81.8
Alewife	9,260	15,842	71.1
Porter, North	10,378	18,896	82.0
Porter, South	12,688	29,783	134.7
MEAN VALUE OF SINGLE-FAMILY HOMES:			
Boston SMSA	$23,800	$56,000	135.3
Cambridge	31,367	75,300	140.1
Alewife	20,685	45,475	119.8
Porter, North	28,303	56,811	100.7
Porter, South	48,873	122,034	149.7
PERCENT 25+ WITH FOUR OR MORE YEARS OF COLLEGE:			
Boston SMSA	15.8	27.3	73.2
Cambridge	30.1	45.7	51.5
Alewife	11.0	24.6	124.3
Porter, North	25.2	40.7	61.6
Porter, South	55.6	85.1	52.9

Source: U.S. Census of Population and Housing, 1970 and 1980

Only the percent of the population with a college education increased less than the other areas, principally because the percent was already double that of the other zones in 1970, and had less room to increase.

Porter, North

When crossing north of Upland Road, though still in the shadow of Porter Square, the economic and demographic indicators change radically. In 1980, the mean value of a single family home in Porter, North was one-half the mean value in Porter, South, reflecting both the change in location,

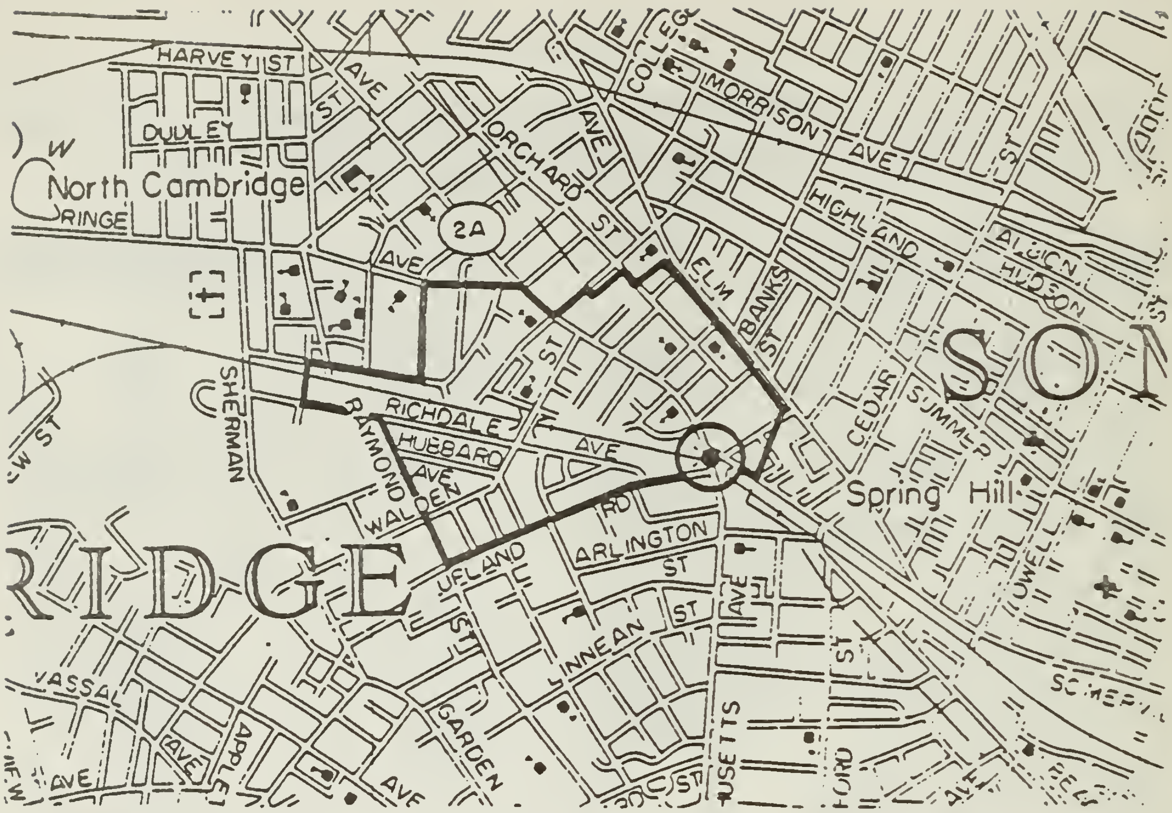


Figure 6.2. PORTER, NORTH IMPACT AREA

and the change in housing stock. Though sturdy, the homes in this area are on average more modest than the diverse homes found in Porter, South. In many respects, the area mirrors the population of Cambridge, itself. The median family income was just $1,000 above that of the entire city, and rose at about the same rate over the decade. In 1980, 41% of the population 25 years old or older had finished at least four years of college, up from 25% in 1970, a shift parallel to the city as a whole.

Like Cambridge, the Porter, North area is clearly in transition. Figure 6.3 displays two key indicators discussed earlier in this chapter: one-person households and families with children. Of all the Cambridge impact zones, Porter, North most closely follows the movements of the rest of the

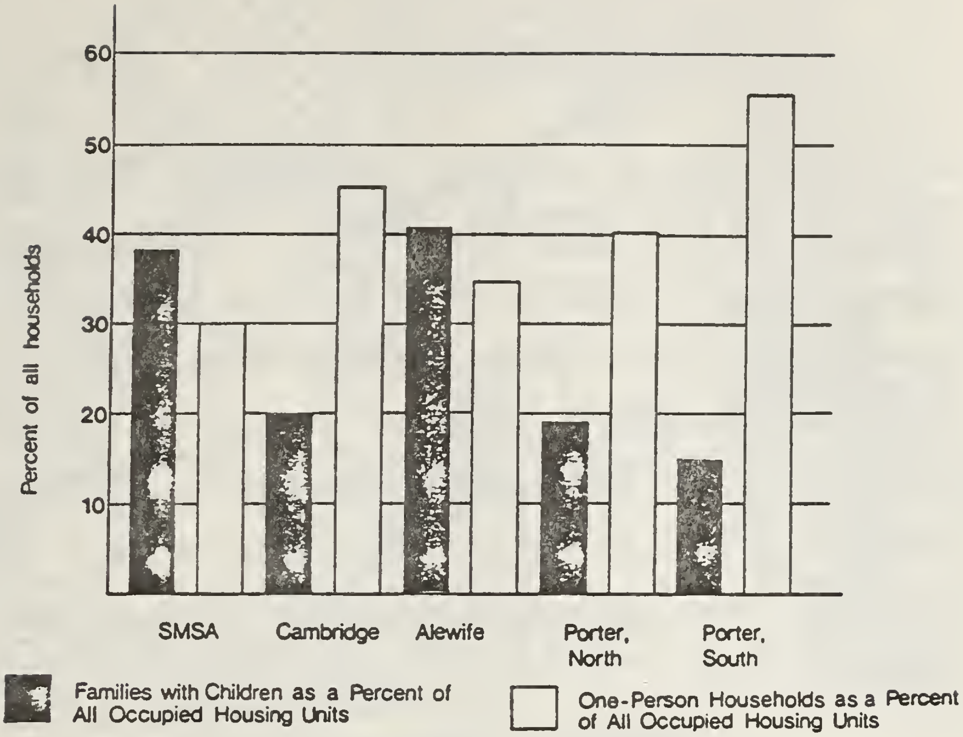


Figure 6.3.

Single Person Households and Families with Children

city. However, Porter, North has reached this level by changing much more rapidly than Cambridge over the decade. Single-person households increased by 56% over that period compared to 39% for the city as a whole, and families with children dropped by 31% as opposed to 12% city-wide. By 1980, Porter, North was thus already experiencing rapid change, well before the opening of the station.

Alewife

Driving north from Porter Square along Massachusetts Avenue, one yet passes an occasional "trackless trolley." Though most of the bus lines coming south from Arlington and Belmont are now routed to the Alewife station, the old electric buses, which draw their power from the overhead trolley cables, are still providing local service from Harvard Square to

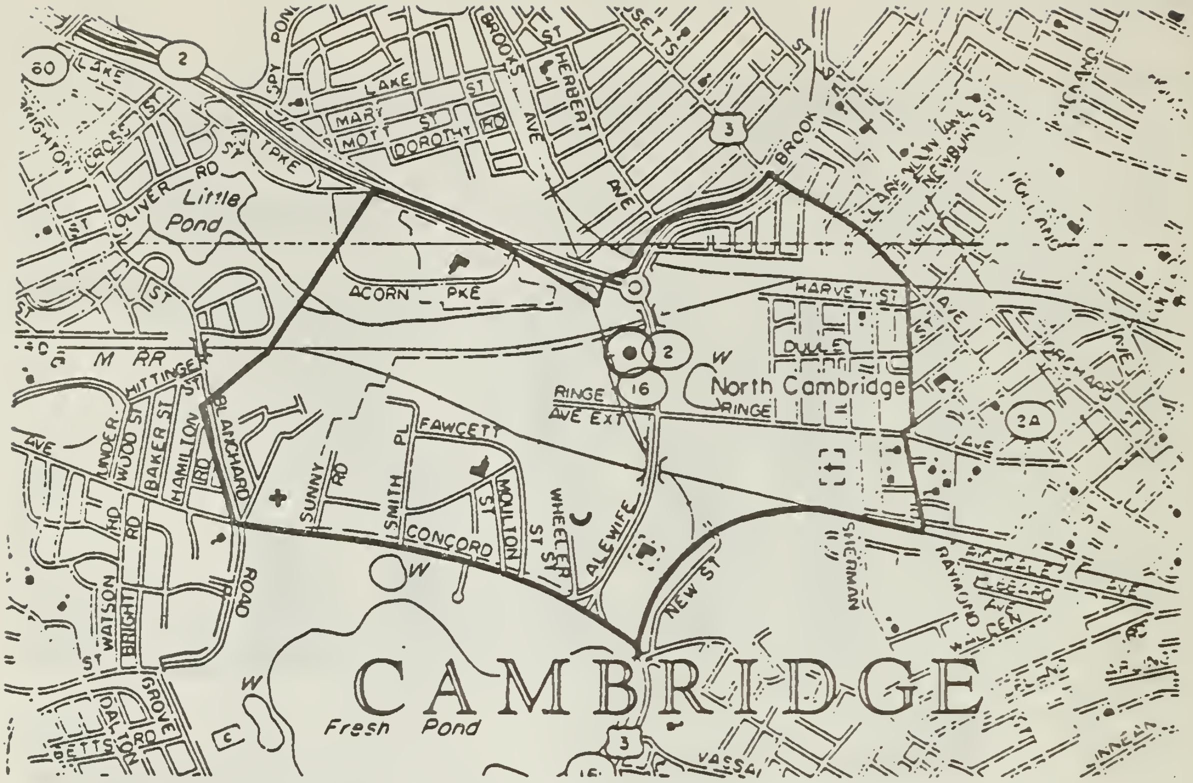


Figure 6.4. ALEWIFE STATION IMPACT AREA

North Cambridge, though less often, to the consternation of some local residents.

The trackless trolleys terminate their service at "Trolley Square," the location of a small MBTA yard at the intersection of Massachusetts Avenue and Harvey Street, the last major intersection before the Alewife Brook Parkway. West of Trolley Square is the impact area identified here as Alewife. At its southern edge is the Fitchburg Main Line of the Boston and Main Railroad, the Cambridge Housing Authority's Jefferson Park Veterans Housing Project and Concord Avenue. On the east is the Russell Athletic Field and the substantial industrial facilities of the W.R. Grace Company (across the Alewife Brook Parkway from the Alewife station). The impact area extends beyond the station to the Belmont town line to the west. On the north is the Alewife Brook Parkway, the Concord Turnpike and the Town of Arlington.

Compared to the zones already visited, the changing demography of the City of Cambridge is least evident in the Alewife impact area. In 1980, 40% of the Alewife households were families with children, a higher percentage than the region, nearly twice the percent of the city of Cambridge and more than twice that of the other impact zones. Single-person households made up only one-third of the Alewife households and less than one-quarter of those employed were in professional, technical or managerial occupations. The mean value of a single-family home was the lowest as well. Other indicators show a similar pattern.

The width of the divergence from the city-wide trend reflects in part two major subsidized housing developments located in the neighborhood: the Cambridge Housing Authority's, 309 unit Jefferson Park public housing project and next to it the privately owned, 777 unit Ringe Towers, financed under the H.U.D. Section 236 program. Both are located along Ringe Avenue. It is possible to analyze the extent to which the developments have widened the demographic gap between the Alewife area and the city by analyzing separately the block group in which the developments are located. The developments represent approximately 85% of the units in that block group.

Table 6.4 reviews four of the demographic indicators for the Red Line impact areas, with the Alewife area now broken down further between Block Group 2, which contains the two housing projects, and the remainder of the impact zone. There is clearly a major difference. Block Group 2, with

Table 6.4

SELECTED DEMOGRAPHIC INDICATORS: CAMBRIDGE, 1980

	Single Person Households*	Families With Children*
Boston SMSA	30.3	37.5
Cambridge	44.8	20.9
Alewife	32.3	39.5
Block Group 2	20.3	48.7
Remainder of Alewife	35.8	22.1
Porter, North	39.3	18.2
Porter, South	51.6	15.9

	Persons Employed In Managerial, Professional, or Technical Occupations**	Persons 25+ With Four or More Years of College***
Boston SMSA	-	27.2
Cambridge	39.8	45.7
Alewife	23.3	24.6
Block Group 2	11.2	18.7
Remainder of Alewife	32.0	29.1
Porter, North	37.7	40.7
Porter, South	62.8	85.1

* Percent of all occupied housing units.
** Percent of all employed persons over 16.
*** Percent of all persons over 25.

Source: Census of Population and Housing, General Population Characteristics, 1980.

approximately 600 units of subsidized housing, has a much higher percentage of families with children and a much lower percentage of single-person households than found in the remainder of the impact area.

Even subtracting the impact of the subsidized housing developments, the remainder of the Alewife area still reflects the changing demographic trends less than the other impact zones, though not so much less as when Block Group 2 is included. Only 36% of the households in 1980 contained only one person, for example, compared to 45% for the city, and 29% of those over 25 had completed at least four years of college, compared with 46% city-wide. Only about one-third were employed in professional, technical, or managerial occupations. In 1980, the Alewife impact area looked demographically more like the Cambridge of ten years earlier.

B. Somerville

In contrast to Cambridge, Somerville in 1980 was much more of a working-class community. Just over 21% of the city's labor force was employed in professional, technical, or managerial occupations, about half that of its neighbor. Approximately 15% of those over 25 years of age had completed at least four years of college, about one-third the percent of Cambridge and half that of the region. The city's median family income of $18,220 was only 80% of the median for the region and just $400 over the median family income of Cambridge, despite the latter community's greater percentage of rental and subsidized housing units.

During the 1970's, Somerville was experiencing some rapid demographic changes of its own. These are shown in Table 6.5. Most notable was the

Table 6.5

SELECTED DEMOGRAPHIC INDICATORS: SOMERVILLE

	1970	1980
Population	88,779	77,372
Occupied Housing Units	28,999	29,687
Renter Occupied Units	19,115 (65.9%)	19,955 (68.8%)
Families With Children	10,923 (37.7)	8,132 (28.0)
One Person Households	6,018 (20.8)	8,924 (30.8)
Persons 25 Years or Older With 4 or More Years of College	2,993 (6.0)	7,738 (15.5)

Source: U.S. Census of Population and Housing, 1970, 1980.

decline of families with children, which dropped from 38% to 28% of all households. At the same time, single-person households increased from 21% to 31% of all households, similar to the regional trend. For both indicators, the percentage change was much greater than for Cambridge over the same period, though by the end of the decade Somerville still had a higher percentage of families with children, and a lower percentage of one person households, than its neighbor.

Porter, Somerville

One block east of the Porter Square station is Elm Street and the Somerville City Line. A twenty block area mostly to the east of Elm Street has been identified in this study as Porter, Somerville. This is an area which, though still generally reflecting the demographics of the city in which it is located, appears to be falling under the influence of the trends affecting Porter Square to the west.

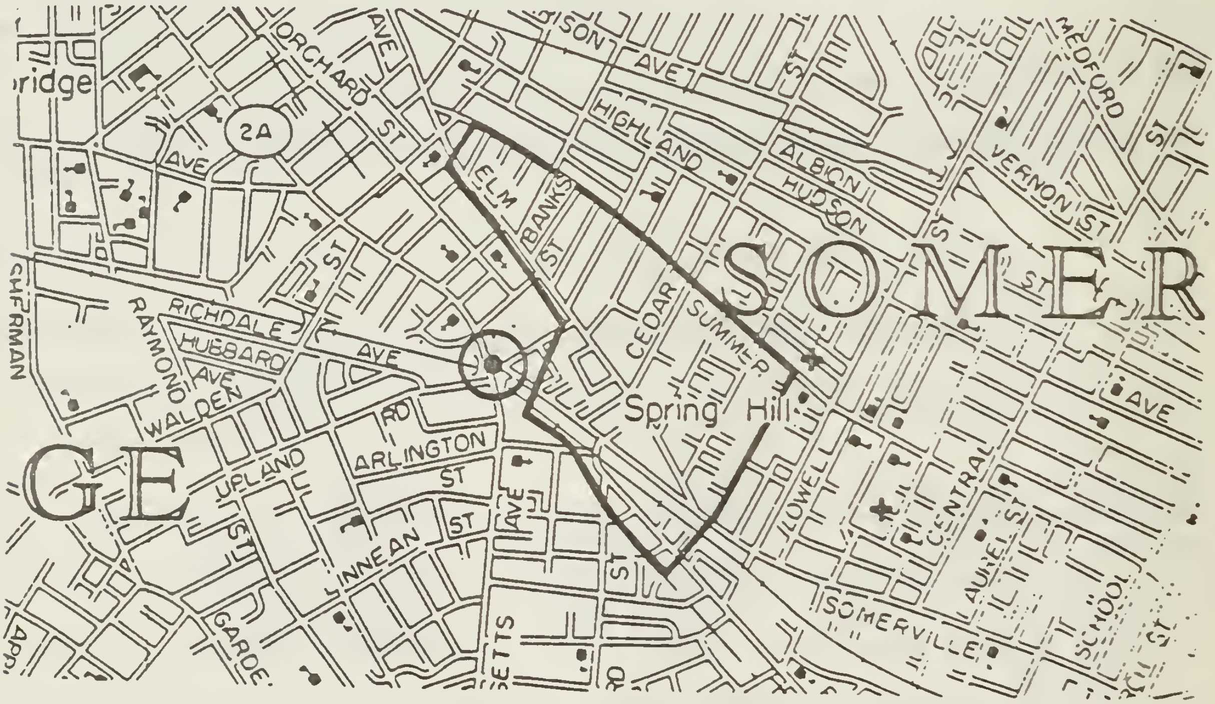


Figure 6.5. PORTER, SOMERVILLE IMPACT AREA

Somerville, Porter is an area of predominantly two- and three-family homes, with a few older apartment buildings along Elm Street and Somerville Avenue. The area is nearly three-quarters rental, slightly higher than the city as a whole. The total number of housing units in the neighborhood remained fairly stable over the decade, and thus with the decline in household size, the population of the area dropped by about 15%.

Perhaps due to the high percentage of rental units, mobility is slightly higher in the Porter area. The data in Table 6.6 shows that 56% of all households have moved in within the last five years, about the same level

Table 6.6

SELECTED DEMOGRAPHIC INDICATORS:
SOMERVILLE RED LINE IMACT ZONES, 1970-1980
(Percent of all households)

	1970	1980	Percent Change
RECENT MOVERS:			
Boston SMSA	50.0%	53.2 %	15.7%
Somerville	45.2	51.0	12.8
Porter	46.9	56.0	19.3
Davis	43.6	46.2	6.0
FAMILIES WITH CHILDREN:			
Boston SMSA	40.5	37.5	- 7.5
Somerville	37.7	28.0	-25.5
Porter	36.5	24.8	-32.2
Davis	36.5	23.8	-34.8
SINGLE PERSON HOUSEHOLDS:			
Boston SMSA	19.9	30.3	52.4
Somerville	20.7	30.8	48.3
Porter	20.1	31.3	60.1
Davis	24.5	30.9	26.4

Source: U.S. Census of Population and Housing, 1970, 1980.

as the region and a little above Somerville as a whole. Mobility is usually followed by change, and the Porter area is undergoing some of the demographic shifts discussed in this report somewhat faster than the remainder of the city. Both the percent of families with children and the percent of one-person households were very similar to the city in 1980, but for both factors the neighborhood changed more rapidly in order to arrive at that point. In this respect, Porter, Somerville is similar to Porter, North in Cambridge which also "caught-up" with its city-wide patterns over the 1970's.

Table 6.7

INCOME, HOME VALUE AND EDUCATION
SOMERVILLE RED LINE STUDY IMPACT AREAS
1970-1980

	1970	1980	Percent Change
MEDIAN FAMILY INCOME:			
Boston SMSA	$11,449	$22,848	96.6%
Somerville	9,594	18,220	89.9
Porter	9,872	18,732	89.7
Davis	10,551	19,001	80.1
PERCENT OF PERSONS 25+ WITH FOUR OR MORE YEARS OF COLLEGE:			
Boston SMSA	15.8%	27.3%	73.2%
Somerville	6.0	15.5	158.5
Porter	7.1	21.5	200.0
Davis	7.5	15.3	104.6
MEAN VALUE OF SINGLE-FAMILY HOME:			
Boston SMSA	$23,800	$56,000	135.3%
Somerville	17,216	44,000	155.6
Porter	16,526	43,371	162.4
Davis	19,150	42,537	122.4

Source: U.S. Census of Population and Housing, 1970, 1980.

The median family income in Porter, Somerville and the percent of persons employed in professional, technical, or managerial occupations has remained very close to the city-wide average over the decade. The area has shown a more dramatic increase in terms of educational attainment, however. The percent of persons over 25 years of age which had completed four or more years of college increased by 200% between 1970 and 1980, nearly twice the percent increase in Davis Square.

The Porter, Somerville area, though reflecting the city of Somerville, still revealed a slight demographic "tug" between 1970 and 1980 from neighboring Cambridge, perhaps as a result of its proximity to Porter Square. This is a force which may well become stronger as the community moves through the 1980's, particularly if the influence of Harvard Square continues to expand on the Cambridge side of the line.

Davis Square

About a half mile up from Porter Square, Elm Street meets a number of main streets at Davis Square. One of these, Highland Avenue, is the major artery to East Somerville and the city's municipal complex. Another is College Avenue, on which Powderhouse Square and the campus of Tufts University, the city's primary institution of higher education, lie one-half mile east. Holland Street runs through Davis Square and connects it to Teele Square, leading eventually to the Arlington town line.

The Davis Square impact area extends from Powderhouse Square at the northeast corner, west to the Cambridge city line, and south to the area identified as the Porter, Somerville impact area.

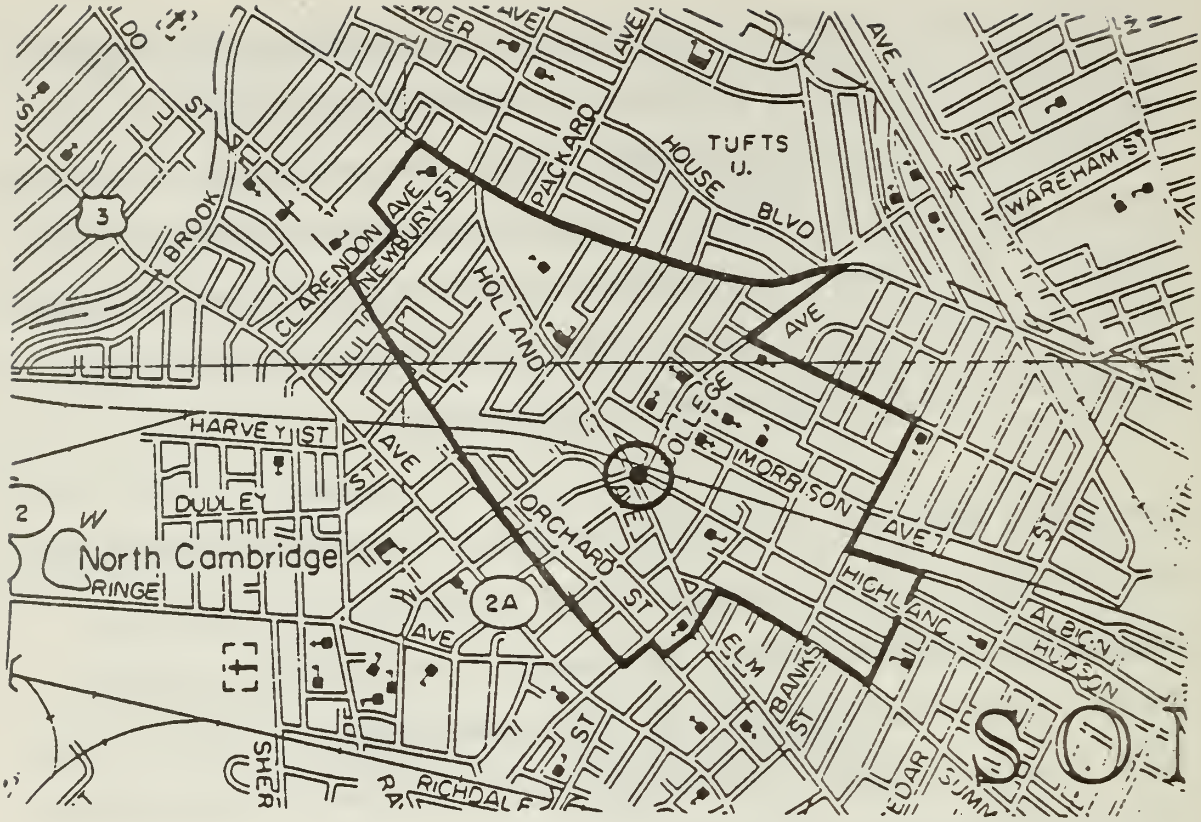


Figure 6.6. DAVIS SQUARE IMPACT AREA

When exiting the Davis Square MBTA station, one is immediately struck by the fresh appearance of the surroundings which contradict with memories of an older, deteriorating business district. The new improvements to the streets and pedestrian ways have the crisp look of new brick, granite and concrete, installed by the city and the MBTA to complement the Red Line construction. Many of the commercial buildings in the immediate vicinity of the headhouse have undergone facade renovation, most with support from Somerville's Community Development Program.

At Davis Square, the station art stands out in contrast to that of Porter. Along the platforms underground, graphics depict scenes from the old Davis Square. In the small park constructed across from the station stands "Fisherman and Fisherwoman," a sculpture by James Tyler, looking as though it were modeled upon any pair of Davis Square residents.

Between 1970 and 1980, the neighborhood around Davis Square experienced a 5% drop in the total number of occupied housing units, which translated into a substantial 21% drop in population. In 1980, approximately two-thirds of the housing units in the Davis Square neighborhood were rental, somewhat less than in the Porter area or the rest of Somerville. It is not surprising, then, to find that the median family income in 1980 was also somewhat higher than that of the city, reflecting the larger percentage of owners. Mobility, as measured by recent movers, was also somewhat lower. In spite of the fact that Tufts University is about a half mile away, the neighborhood had a smaller percentage of college students than either the Porter area or Somerville as a whole.

The Davis Square neighborhood is quite similar to the city in its percentage of families with children and single-person households: the former fell dramatically while the latter increased. To some extent, all of Somerville and the Porter area appear to have "caught up" with Davis Square. The Davis Square area started the decade with income, single-family home values and educational attainment factors which were somewhat higher than the rest of the city, but these increased at a lower rate and thus they ended the decade in a position very comparable to the remainder of the city.

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APPENDIX B
BUS REROUTINGS

Following the opening of the extension to Alewife, four local routes (Routes 62, 67, 76 and 84) and one express route (Route 350) were re-routed to Alewife, and two new routes (Routes 79 and 94) were instituted, one serving Alewife and one serving Davis. In addition, service was reduced on Routes 77, 77A, 83, 88, and 89, all of which were expected to experience diversion of ridership to the new Red Line extension. Lastly, changes were also made to the alignment of Route 78, which continued to terminate at Harvard Station, and to Route 87, where most trips were extended from Clarendon Hill in Somerville to Arlington Center. In more detail, these changes were as follows:

Route 62 Until June 1985, Route 62 operated from the Bedford VA hospital in Bedford to Arlington Heights through Bedford Center and Lexington Center. To travel to the Red Line, it was necessary to transfer to Route 77 at Arlington Heights, and then travel to Harvard Station. Following the inauguration of the red line extension, Route 62 was extended from its old terminus at Arlington Heights to Alewife Station along Park Ave and the Route 2 service roads. This extension provided direct connections with the Red Line and increased the route's one way mileage from 8.5 miles to 12.1 miles. At the same time, the level of service was increased significantly from 16 round trips to 28.5 round trips per day (Fall 1986). All of the additional service was added in the peak periods, where headways were reduced from 60 minutes to 30 minutes.

Route 67 Prior to the Red Line extension, Route 67 operated between Five Forks in Lexington near Route 128 to Arlington Center through Lexington Center and the Turkey Hill area of Arlington. As with Route 62, travel to the Red Line first required a transfer to Route 77. In June 1985, service on the outer portion of the route between Five Forks and Turkey Hill was terminated, while the inner end of the route was extended from Arlington Center to Alewife Station. The impact of these changes was to reduce the one-way route mileage from 8.7 miles to 3.6 miles, and to change the route from essentially a local surburban route to a local rapid transit feeder route. In conjunction with the alignment change, the level of service was significantly increased from eight round trips per day to 19 round trips per day. This increase in service reduced peak period headways from 60 to 70 minutes to 25 minutes. In addition, whereas service was provided on the "old" Route 67 only during peak periods, service is now provided throughout the day at 45 minute headways.

Route 76 Route 76 previously operated from Hanscom AFB in Bedford to Harvard Station via Five Forks, Lexington Center, Massachusetts Avenue to Pleasant Street, Route 2, Alewife Brook Parkway, Massachusetts Avenue, and Porter Square. Following the opening of Alewife Station, the segment of the route from the Alewife Rotary to Harvard Square along the Alewife Brook Parkway and Massachusetts Avenue was eliminated, with all service re-routed into Alewife Station. For trips into Boston, re-routing shifted the location of the transfer to the Red Line from Harvard Square to Alewife; for trips to Porter Square or Harvard Square, a new transfer was imposed where one did not previously exist. The level of service on this route was also significantly increased from 18 to 34.5 round trips per weekday, with the additional service added during peak periods to reduce headways from 60 minutes to 30 minutes. In much of Lexington, combined service on Route 62 and 76 now provides peak period service to the Red Line at Alewife at 15 minutes headways, compared to prior headways to the Red Line at Harvard of 60 minutes on Route 76. The re-routing of Route 76 to Alewife also reduced on-way route mileage from 15.2 miles to 9.5 miles.

Route 77 The alignment of Route 77, which operates between Arlington Heights and Harvard Square along Mass Ave has not been changed since the opening of the Red Line extension. However, service was reduced as a result of expected diversion to the new Red Line along the inner end of the route, and to create a new route (Route 79 - see below) serving the same area as Route 77 but to Alewife. On an all day basis, the total number of round trips has been reduced from 183.5 to 159. During peak periods, headways have been increased from three to four minutes to seven to seven and one half minutes. Slightly longer headways are also provided during off-peak periods, ranging from eight to twelve minutes.

Route 77A Route 77A is a short turn of Route 77 operating from North Cambridge to Harvard Square. As with Route 77, the alignment of Route 77A remains the same, but the level of service has been reduced. For Route 77A, the weekday number of round trips has been reduced from 114 to 91, with slightly increased headways in the AM peak, mid-day, and PM peak periods.

Route 78 Route 78 operates between Park Circle in Arlington and Harvard Station through the northeastern corner of Belmont. This route has remained essentially unchanged since the opening of Alewife station. However, much of the area served by this route is also served by routes that have been re-routed to Alewife (Routes 76 and 84), therefore ridership has been affected.

Route 79 Route 79 was implemented essentially as a variation of Route 77 following the opening of the Alewife Station, and operates between Arlington Heights and Alewife via Arlington Center. The route operates along the same alignment as Route 77 between Arlington Heights and Alewife Brook Parkway, and then along the Alewife Brook Parkway into Alewife Station. The route was designed to provide quicker access to the Red Line to those who previously rode Route 77 to Harvard. Sixty and one-half round trips per week day provide headways of 7 to 7.5 minutes during peak periods and from 17 to 45 minutes during other periods.

Route 83 Route 83, like Routes 77, 77A, and 84, has remained unchanged in alignment since the opening of the Alewife extension. Much of Route 83's alignment is within walking distance of the Red Line. The route begins on Rindge Ave in North Cambridge within sight of the Alewife Station, and travels through Porter Square and Inman Square to Central Square. Since the opening of the extension, service levels have remained largely unchanged, although headways have been increased slightly in the AM Peak.

Route 84 Prior to the Alewife extension, Route 84 operated between the Arlmont area of Arlington near the Belmont and Lexington lines to Harvard Station via the Route 2 service roads, Alewife Brook Parkway and Massachusetts Avenue. Since the opening of Alewife Station, the route has been terminated at Alewife. In addition, some minor re-routings have also taken place at the Arlmont end of the route. In total, one-way route mileage has been reduced from 6.9 miles to 4.5 miles. As with the other routes that have been re-routed into Alewife, additional service is also being provided. On Route 84, service is now being provided throughout the day at 30 minute headways.

Route 87 Prior to the Red Line extension, Route 87 operated between Clarendon Hill and Lechmere. Since the opening of the extension, most service (all except early morning and after 7:00 PM) has been extended from Clarendon Hill to Arlington Center, providing additional access to the Red Line from Arlington, making connections at Davis. With the route changes, headways were also lengthened somewhat, from 11 minutes in the peaks to 15 to 16 minutes, and from 20 minutes mid-day to 25 minutes. Route mileage from Clarendon Hill to Lechmere is 4.1 miles each way, and from Arlington Heights to Clarendon Hill an additional 1.4 miles.

Route 88 Route 88 operates between Clarendon Hill in Somerville and Lechmere Station along Broadway, Holland

Street, Highland Avenue and the McGrath O'Brien Highway. Since the opening of the Red Line extension, this route now provides connections with the rapid transit system at Davis as well as Lechmere. As a result, many patrons who formerly rode Route 88 to Lechmere can now directly access the rail transit system at Davis. The alignment of this route has remained unchanged, but the number of daily round trips provided has been reduced from 76.5 to 64. Headways have been increased from 5 and 8 minutes in the AM and PM peaks, respectively, to 8 and 14 minutes. Mid-day headways have also been increased from 20 minutes to 25 minutes.

Route 89 Route 89 is similar in nature to Route 88 in that it provides service in an east-west direction through Somerville, but provides service between Clarendon Hill and Sullivan Station. The route operates along Broadway for its entire alignment. Route 89 does not connect with the Red Line as does Route 88, but ridership has been affected since faster connections to the rail transit system from Route 89's service area can now be made via Routes 87, 88, 94 and 96 to Davis than on Route 89 to Sullivan. As a result, service has been reduced slightly from 69.5 daily round trips to 64.5, by increasing peak period headways from 8 minutes to 9 minutes.

Route 94 Service on Route 94 was instituted in the Spring of 1985 to provide service between West Medford and Harvard Square, via Tufts University, Davis Square and Porter Square. Shortly after service began, in the Summer of 1985, the route was revised at both ends. At the West Medford end, service was extended from West Medford to Medford Square along High Street. At the inner end, service operating parallel to Route 96 between Davis Square and Harvard was terminated. Between West Medford and Davis Square, the route operates along Boston Avenue and College Avenue. One-way route mileage is 4.3 miles. Fifty three round trips are provided daily, with 15 minute headways in the peak periods, 30 minutes mid-day and 40 minutes at night.

Route 96 Prior to the Red Line extension, this route had two variations, 96 and 96A. Both operated between Medford Square and Harvard Square but travelled different alignments through residential areas between Medford Square and Tufts University. In Medford, variation 96 travelled from Main Street to Winthrop Street via George Street, while 96A operated between Main Street and Winthrop Street along South Street. Following the opening of the Red Line extension, variation 96A was terminated, but variation 96 has been continued along the same alignment. With the elimination of Route 96A and the institution of service on Route 94, the total level of service of Route 96 has been reduced from 73 daily round trips to 48. Peak period headways have been increased from 10 to 15 minutes, and mid-day headways have been increased from 15 to 30 minutes.

Route 350 Route 350 is an express route operating from the Burlington/Billerica line on Route 3A. Prior to Alewife, the route operated to Haymarket Square in Boston via Burlington Center, the Burlington Mall, Four Corners in Woburn, Winchester, Arlington Center, Porter Square, Inman Square, and Kendall Square, operating as local service to Arlington Center, and then as express service to Boston. The outer end of the route has remained unchanged, but the inner end between the intersection of Massachusetts Avenue and Alewife Brook Parkway and Haymarket has been eliminated with all service re-routed to Alewife. This change has reduced one-way route mileage from 15.2 miles to 10.8 miles. Headways have remained unchanged with the exception of slightly longer headways in the AM peak (12 minutes versus 10 minutes).

APPENDIX C
PASSENGER SURVEY RESULTS - SOCIOECONOMIC AND TRIP CHARACTERISTICS

Alewife Before/After Study
Miscellaneous Survey Data (Expanded)

	CURRENT BOARDING STATION				
	Alewife	Davis	Porter	Harvard	**Total**
AUTO OWNERSHIP/USE DATA:					
1. Number of Cars In Household					
None	667	1,430	1,483	3,179	**6,759**
	13.43%	29.71%	37.25%	21.71%	**23.80%**
One	1,913	1,962	1,698	7,785	**13,358**
	38.51%	40.77%	42.66%	53.17%	**47.03%**
Two	2,810	993	587	2,959	**7,349**
	56.56%	20.64%	14.75%	20.21%	**25.88%**
Three +	621	427	212	719	**1,980**
	12.51%	8.88%	5.33%	4.91%	**6.97%**
Total	**4,968**	**4,812**	**3,981**	**14,642**	**28,403**
2. Car Available for Surveyed Trip?					
Yes	3,320	2,352	1,751	8,014	**15,436**
	66.82%	48.87%	43.99%	54.73%	**54.35%**
No	1,648	2,460	2,230	6,628	**12,967**
	33.18%	51.13%	56.01%	45.27%	**45.65%**
Total	**4,968**	**4,812**	**3,981**	**14,642**	**28,403**
3. Own Car Used for Part of Surveyed Trip (Drive Alone Access Mode)?					
Yes	1,529	332	220	214	**2,295**
	46.06%	14.12%	12.56%	2.67%	**14.87%**
No	1,791	2,020	1,531	7,800	**13,141**
	53.94%	85.88%	87.44%	97.33%	**85.13%**
Total	**3,320**	**2,352**	**1,751**	**8,014**	**15,436**

Alewife Before/After Study
Miscellaneous Survey Data (Expanded)

	CURRENT BOARDING STATION				
	Alewife	Davis	Porter	Harvard	Total
AGE OF RIDERS:					
17 or Under	44	37	74	228	383
	0.88%	0.76%	1.87%	1.56%	1.35%
18 to 24	700	1,073	947	3,461	6,181
	14.09%	22.29%	23.79%	23.64%	21.76%
25 to 34	1,612	2,167	1,575	4,819	10,173
	32.45%	45.04%	39.56%	32.91%	35.82%
35 to 44	1,123	731	826	3,063	5,743
	22.60%	15.20%	20.75%	20.92%	20.22%
45 to 64	1,219	698	383	2,425	4,724
	24.53%	14.50%	9.63%	16.56%	16.63%
65 or Older	271	106	175	646	1,198
	5.46%	2.21%	4.40%	4.41%	4.22%
Total	4,968	4,812	3,981	14,642	28,403

	Alewife	Davis	Porter	Harvard	Total
ANNUAL FAMILY INCOME OF RIDERS					
Less than $10,000	301	550	613	1,120	2,585
	6.05%	11.44%	15.41%	7.65%	9.10%
$10,000 - $19,999	542	1,421	1,085	2,756	5,803
	10.91%	29.52%	27.25%	18.82%	20.43%
$20,000 - $29,999	909	1,138	775	4,330	7,152
	18.30%	23.65%	19.47%	29.57%	25.18%
$30,000 - $39,999	847	653	627	1,600	3,728
	17.05%	13.57%	15.76%	10.93%	13.12%
$40,000 - $49,999	599	459	393	1,477	2,928
	12.05%	9.54%	9.86%	10.09%	10.31%
$50,000 or More	1,771	591	488	3,359	6,209
	35.65%	12.28%	12.26%	22.94%	21.86%
Total	4,968	4,812	3,981	14,642	28,403

Alewife Before/After Study
Miscellaneous Survey Data (Expanded)

	CURRENT BOARDING STATION				
	Alewife	Davis	Porter	Harvard	Total
ORIGIN TOWN OF RIDERS					
Cambridge	715	371	2,038	10,601	13,725
	14.40%	7.70%	51.20%	72.40%	48.32%
Somerville	298	3,287	1,385	469	5,439
	6.00%	68.30%	34.80%	3.20%	19.15%
Arlington	1,595	245	374	922	3,137
	32.10%	5.10%	9.40%	6.30%	11.04%
Belmont	288	10	0	1,215	1,513
	5.80%	0.20%	0.00%	8.30%	5.33%
Lexington	825	10	60	59	953
	16.60%	0.20%	1.50%	0.40%	3.35%
Medford	25	813	20	0	858
	0.50%	16.90%	0.50%	0.00%	3.02%
Other	1,222	77	104	1,376	2,779
	24.60%	1.60%	2.60%	9.40%	9.78%
Total	4,968	4,812	3,981	14,642	28,403
	100.00%	100.00%	100.00%	100.00%	100.00%

Alewife Before/After Study
Miscellaneous Survey Data (Expanded)

	CURRENT BOARDING STATION				
	Alewife	Davis	Porter	Harvard	Total
DESTINATION TOWN OF RIDERS					
BOSTON					
Financial/Retail	1,370	600	738	1,532	4,240
	27.58%	12.46%	18.53%	10.47%	14.93%
Government Center	523	476	402	1,482	2,883
	10.52%	9.90%	10.11%	10.12%	10.15%
Fenway/Parker Hill	236	312	201	1,667	2,416
	4.75%	6.48%	5.05%	11.39%	8.50%
Park Square	312	35	289	320	956
	6.28%	0.73%	7.26%	2.19%	3.37%
Back Bay	191	288	206	455	1,140
	3.85%	5.99%	5.18%	3.11%	4.01%
Beacon Hill	280	247	119	303	949
	5.64%	5.13%	2.98%	2.07%	3.34%
Other Boston	605	606	31	2,644	3,886
	12.18%	12.59%	0.78%	18.06%	13.68%
Total Boston	3,517	2,564	1,986	8,402	16,470
	70.80%	53.28%	49.90%	57.39%	57.99%
Cambridge	1,068	1,540	1,206	2,138	5,952
	21.50%	32.00%	30.30%	14.60%	20.96%
Somerville	75	38	12	893	1,018
	1.50%	0.80%	0.30%	6.10%	3.58%
Brookline	50	58	107	512	727
	1.00%	1.20%	2.70%	3.50%	2.56%
Other	258	612	669	2,696	4,236
	5.20%	12.72%	16.80%	18.42%	14.91%
Total	4,968	4,812	3,981	14,642	28,403
	100.00%	100.00%	100.00%	100.00%	100.00%

Alewife Before/After Study
Miscellaneous Survey Data (Expanded)

	CURRENT BOARDING STATION				
	Alewife	Davis	Porter	Harvard	Total
TRIP PURPOSES					
Home-Based Work	3,249 65.40%	3,296 68.50%	2,416 60.70%	8,287 56.60%	**17,249** **60.73%**
Home-Based School	412 8.30%	558 11.60%	713 17.90%	1,303 8.90%	**2,986** **10.51%**
Home-Based Shopping	219 4.40%	236 4.90%	271 6.80%	820 5.60%	**1,545** **5.44%**
Home-Based Other	467 9.40%	428 8.90%	354 8.90%	1,479 10.10%	**2,728** **9.61%**
Non-Home-Based	621 12.50%	298 6.20%	227 5.70%	2,738 18.70%	**3,884** **13.68%**
Total	4,968	4,812	3,981	14,642	28,403
BEFORE AND AFTER TRAVEL TIMES OF CURRENT RIDERS (in minutes)					
Before					
Average Travel Time	56	49	48	43	**47**
Median Travel Time	60	45	50	40	**45**
Mode of Travel Time	60	60	60	45	60
After					
Average Travel Time	51	38	39	45	**44**
Median Travel Time	50	40	35	45	**45**
Mode of Travel Time	45	30	30	45	**45**
Percent Difference					
Average Travel Time	-8.93%	-22.45%	-18.75%	4.65%	-6.38%
Median Travel Time	-16.67%	-11.11%	-30.00%	12.50%	0.00%
Mode of Travel Time	-25.00%	-50.00%	-50.00%	0.00%	-25.00%

Alewife Before/After Study
Miscellaneous Survey Data (Expanded)

	CURRENT BOARDING STATION				
	Alewife	Davis	Porter	Harvard	Total
WEEKLY USE OF RED LINE (Number of Days Used per Week)					
Seven Days	48	102	120	350	620
	0.97%	2.12%	3.01%	2.39%	2.18%
Six Days	166	313	272	1,177	1,929
	3.35%	6.51%	6.84%	8.04%	6.79%
Five Days	3,093	2,555	2,055	5,160	12,862
	62.26%	53.09%	51.61%	35.24%	45.28%
Four Days	387	321	286	845	1,839
	7.78%	6.68%	7.19%	5.77%	6.47%
Three Days	255	282	343	1,922	2,802
	5.13%	5.86%	8.62%	13.13%	9.87%
Two Days	263	384	185	1,381	2,213
	5.29%	7.98%	4.65%	9.43%	7.79%
One Day	123	290	226	758	1,398
	2.48%	6.03%	5.68%	5.18%	4.92%
Less than One Day	633	564	493	3,048	4,739
	12.74%	11.73%	12.39%	20.82%	16.69%
Total	4,968	4,812	3,981	14,642	28,403
	100.00%	100.00%	99.99%	100.00%	100.00%

APPENDIX D
QUESTIONNAIRE

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 2521 BOSTON MA

Postage will be paid by addressee

Central Transportation Planning Staff
Suite 2150
10 Park Plaza
Boston, MA 02116

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

№ 7534

Passenger Survey/Red Line Extension

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

The information you provide on this survey will help the MBTA to evaluate the new Red Line extension. Please answer as many questions as you can. Then drop the completed form in the box provided on the platform or in any U.S. mailbox. We will pay postage. Thank you.

1. AT WHICH STATION WERE YOU HANDED THIS QUESTIONNAIRE?

6-1 ☐ Alewife
-2 ☐ Davis
-3 ☐ Porter
-4 ☐ Harvard

2. HOW DID YOU GET TO THIS STATION TODAY?

7-1 ☐ drove alone and parked
-2 ☐ drove with others and parked
-3 ☐ rode with others and parked
-4 ☐ dropped off at station
-5 ☐ MBTA bus (Route # ________________)
-6 ☐ non-MBTA bus (Company ________________)
-7 ☐ commuter rail
-8 ☐ walked directly (from home, work, school, etc.)
-9 ☐ bicycled
-0 ☐ other (____________________)

8 ☐☐☐
11 ☐☐☐

3. AT WHICH STATION WILL YOU LEAVE THE RAPID TRANSIT SYSTEM?

____

14 ☐☐☐

4. PLEASE ANSWER THE FOLLOWING QUESTIONS FOR YOUR ENTIRE ONE-WAY TRIP (NOT JUST THE RED LINE PART)

a. WHERE DID YOU BEGIN THIS TRIP?

17-1 ☐ my workplace
-2 ☐ my home
-3 ☐ my school
-4 ☐ a store or shopping area
-5 ☐ other (____________)

b. WHERE IS THAT LOCATED?

18 ☐☐☐
21

____
(city, town or neighborhood) (zip code)

c. WHERE WILL THIS TRIP END?

26-1 ☐ my workplace
-2 ☐ my home
-3 ☐ my school
-4 ☐ a store or shopping area
-5 ☐ other (____________)

d. WHERE IS THAT LOCATED?

27 ☐☐☐
30

____
(city, town or neighborhood) (zip code)

5. DID YOU USUALLY USE THE RED LINE FOR THIS TRIP BEFORE THE EXTENSION BEYOND HARVARD OPENED IN DECEMBER 1984?

35-1 ☐ yes - ***If yes, go to question 6***
2 ☐ no - ***If no, skip to question 9***

6. BEFORE DECEMBER 1984, AT WHICH STATION DID YOU BOARD THE RED LINE?

36-1 ☐ Harvard or Harvard/Brattle
-2 ☐ Central
-3 ☐ Kendall
-4 ☐ Other (____________________)

7. HOW DID YOU USUALLY GET TO THAT STATION?

37-1☐ drove alone and parked
-2☐ drove with others and parked
-3☐ rode with others and parked
-4☐ dropped off at station
-5☐ MBTA bus (Route #________________)
-6☐ non-MBTA bus (Company________________)
-7☐ walked directly (from home, work, school, etc.)
-8☐ bicycled
-9☐ other (________________)

38☐☐☐
41☐☐☐

8. BEFORE THE EXTENSION BEYOND HARVARD OPENED, HOW MANY DAYS PER WEEK DID YOU USUALLY USE THE RED LINE TO MAKE THIS TRIP?

44-1☐ seven
-2☐ six
-3☐ five
-4☐ four
-5☐ three
-6☐ two
-7☐ one
-8☐ less than one

PLEASE SKIP TO QUESTION 10

9. BEFORE THE RED LINE EXTENSION BEYOND HARVARD OPENED IN DECEMBER 1984, HOW DID YOU USUALLY MAKE THIS TRIP?

45-1☐ did not make this trip
-2☐ drove alone
-3☐ carpooled (# of others in carpool______)
-4☐ bus (route or bus company________________)
-5☐ commuter rail (station________________)
-6☐ walked all the way

47☐
48☐☐☐
51☐

-7☐ Orange or Green line (station________________) 52☐
How did you usually arrive there?

46-1☐ automobile
-2☐ bus (route________________)
-3☐ other (________________)

53☐☐☐

-8☐ bicycled
-9☐ other (________________)

10. BEFORE THE RED LINE EXTENSION OPENED IN DECEMBER 1984, HOW MUCH TIME DID YOU USUALLY ALLOW FOR THIS TRIP?

56☐☐ (minutes, door-to-door)

11. HOW MUCH TIME DO YOU USUALLY ALLOW FOR THIS TRIP NOW?

58☐☐ (minutes, door-to-door)

12. HOW MANY DAYS PER WEEK DO YOU CURRENTLY USE THE RED LINE TO MAKE THIS TRIP?

60-1☐ seven
-2☐ six
-3☐ five
-4☐ four
-5☐ three
-6☐ two
-7☐ one
-8☐ less than one

13. WHAT ARE YOUR MAIN REASONS FOR USING THE RED LINE?
(Check all that apply)

1☐ avoid traffic
2☐ auto not available
3☐ lower cost
4☐ conserve gasoline
5☐ avoid parking
6☐ comfort
7☐ less travel time
8☐ other (________________

61☐☐☐☐

14. AS A RESULT OF THE RED LINE EXTENSION BEYOND HARVARD, DID YOU

1☐ relocate your housing
2☐ change jobs
3☐ change schools
4☐ change work hours
5☐ sell an auto
6☐ change shopping habits
7☐ other (________________)
8☐ none of the above

65☐☐

15. HOW MANY CARS DO YOU HAVE IN YOUR HOUSEHOLD?

67-1☐ none
-2☐ one
-3☐ two
-4☐ three or more

16. DID YOU HAVE AN AUTOMOBILE AVAILABLE FOR THIS TRIP?

68-1☐ yes
-2☐ no

17. WHAT IS YOUR AGE?

69-1☐ 17 or under
-2☐ 18-24
-3☐ 25-34
-4☐ 35-44
-5☐ 45-64
-6☐ 65 or over

18. IN WHICH RANGE IS YOUR ANNUAL FAMILY INCOME?

70-1☐ under $5,000
-2☐ $5,000-$9,999
-3☐ $10,000-$14,999
-4☐ $15,000-$19,999
-5☐ $20,000-$24,999
-6☐ $25,000-$29,999
-7☐ $30,000-$34,999
-8☐ $35,000-$39,999
-9☐ $40,000-$49,999
-0☐ $50,000 and over

19. ON THE LEFT, BELOW, ARE LISTED SEVERAL DIFFERENT MEASURES OF TRANSIT SERVICE QUALITY. PLEASE CIRCLE A NUMBER AFTER EACH MEASURE TO INDICATE HOW YOU FEEL ABOUT MBTA RED LINE RAPID TRANSIT SERVICE.

	very poor		average		unusually good	
Reliability	1	2	3	4	5	71
Cleanliness of the trains	1	2	3	4	5	72
Comfort of the ride	1	2	3	4	5	73
Adequate room on board	1	2	3	4	5	74
Appearance of new stations	1	2	3	4	5	75
Helpfulness of MBTA personnel	1	2	3	4	5	76
Directness of service	1	2	3	4	5	77

THANK YOU FOR COMPLETING THIS SURVEY. PLEASE WRITE ANY COMMENTS/SUGGESTIONS IN THE SPACE BELOW.

78☐☐
80☐☐
82☐☐

№ 7534

Passenger Survey/Red Line Extension

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

The information you provide on this survey will help the MBTA to evaluate the new Red Line extension. Please answer as many questions as you can. Then drop the completed form in the box provided on the platform or in any U.S. mailbox. We will pay postage. Thank you.

1. AT WHICH STATION WERE YOU HANDED THIS QUESTIONNAIRE?

6-1 ☐ Alewife
-2 ☐ Davis
-3 ☐ Porter
-4 ☐ Harvard

2. HOW DID YOU GET TO THIS STATION TODAY?

7-1 ☐ drove alone and parked
-2 ☐ drove with others and parked
-3 ☐ rode with others and parked
-4 ☐ dropped off at station
-5 ☐ MBTA bus (Route #________________)
-6 ☐ non-MBTA bus (Company________________)
-7 ☐ commuter rail
-8 ☐ walked directly (from home, work, school, etc.)
-9 ☐ bicycled
-0 ☐ other (____________________)

8 ☐☐☐
11 ☐☐☐

3. AT WHICH STATION WILL YOU LEAVE THE RAPID TRANSIT SYSTEM?

____

14 ☐☐☐

4. PLEASE ANSWER THE FOLLOWING QUESTIONS FOR YOUR ENTIRE ONE-WAY TRIP (NOT JUST THE RED LINE PART)

a. WHERE DID YOU BEGIN THIS TRIP?

17-1 ☐ my workplace
-2 ☐ my home
-3 ☐ my school
-4 ☐ a store or shopping area
-5 ☐ other (____________)

b. WHERE IS THAT LOCATED?

18 ☐☐☐
21

____
(city, town or neighborhood) (zip code)

c. WHERE WILL THIS TRIP END?

26-1 ☐ my workplace
-2 ☐ my home
-3 ☐ my school
-4 ☐ a store or shopping area
-5 ☐ other (____________)

d. WHERE IS THAT LOCATED?

27 ☐☐☐
30

____
(city, town or neighborhood) (zip code)

5. DID YOU USUALLY USE THE RED LINE FOR THIS TRIP BEFORE THE EXTENSION BEYOND HARVARD OPENED IN DECEMBER 1984?

35-1 ☐ yes - ***If yes, go to question 6***
2 ☐ no - ***If no, skip to question 9***

6. BEFORE DECEMBER 1984, AT WHICH STATION DID YOU BOARD THE RED LINE?

36-1 ☐ Harvard or Harvard/Brattle
-2 ☐ Central
-3 ☐ Kendall
-4 ☐ Other (____________________)

APPENDIX E
PASSENGER SURVEY RESULTS - TRIP BEHAVIOR

RED LINE EXTENSION TO ALEWIFE: BEFORE/AFTER STUDY
NEW USERS: ALEWIFE: ACCESS MODE BY PREVIOUS PRIMARY MODE

	Drove Alone	Carpooled	Bus	Comm Rail	Walked	Orn/Grn Ln	Bicycled	Other	Total
Drove Alone	383	18	115	166	0	57	0	0	739
Drove w/others	26	26	14	38	0	27	0	0	131
Rode w/others	6	0	3	31	0	3	0	0	44
Dropped off	36	27	25	3	0	7	0	11	109
MBTA bus	58	6	281	15	0	18	0	0	378
Non-MBTA bus	3	0	0	24	0	0	0	0	27
Walked	92	7	85	0	6	21	0	0	211
Bicycled	3	0	0	0	0	0	0	0	3
Other	0	0	5	3	0	0	0	0	8
TOTAL	607	83	528	281	6	134	0	11	1,650

RED LINE EXTENSION TO ALEWIFE: BEFORE/AFTER STUDY
NEW USERS: DAVIS: ACCESS MODE BY PREVIOUS PRIMARY MODE

	Drove Alone	Carpooled	Bus	Comm Rail	Walked	Orn/Grn Ln	Bicycled	Other	Total
Drove Alone	61	0	57	0	0	36	0	0	154
Drove w/others	0	20	0	0	9	0	0	0	29
Rode w/others	0	7	0	0	0	0	0	0	7
Dropped off	0	6	20	6	0	34	0	0	67
MBTA bus	34	5	152	0	22	160	0	0	373
Non-MBTA bus	0	0	0	0	0	0	0	0	0
Walked	163	6	401	8	16	421	11	0	1,026
Bicycled	0	0	10	0	0	7	5	0	21
Other	0	0	0	0	0	0	0	0	0
TOTAL	258	44	640	14	46	659	16	0	1,676

RED LINE EXTENSION TO ALEWIFE: BEFORE/AFTER STUDY
NEW USERS: PORTER: ACCESS MODE BY PREVIOUS PRIMARY MODE

	Drove Alone	Carpooled	Bus	Comm Rail	Walked	Orn/Grn Ln	Bicycled	Other	Total
Drove Alone	7	0	12	0	0	22	0	0	42
Drove w/others	11	0	8	0	0	0	0	0	19
Rode w/others	0	0	0	0	0	0	0	0	0
Dropped off	0	15	0	0	0	0	0	0	15
MBTA bus	7	0	7	0	6	4	0	0	25
Non-MBTA bus	0	0	0	0	0	0	0	0	0
Walked	100	18	333	0	69	98	30	14	662
Bicycled	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0
TOTAL	125	33	361	0	76	125	30	14	763

RED LINE EXTENSION TO ALEWIFE: BEFORE/AFTER STUDY
CONTINUING USERS: PORTER: ACCESS MODE BY PREVIOUS ACCESS MODE

	Drove Alone	Drove w/oth	Rode w/ oth	Dropped off	MBTA bus	Walked	Bicycled	Other	Total
Drove Alone	49	0	0	9	0	28	7	0	93
Drove w/others	0	0	0	0	10	0	0	0	10
Rode w/others	0	0	0	0	0	0	0	0	0
Dropped off	5	0	0	0	31	14	0	0	51
MBTA bus	6	0	0	0	283	35	0	0	323
Non-MBTA bus	0	0	0	0	0	0	0	0	0
Walked	33	0	0	24	372	581	33	6	1,050
Bicycled	0	0	0	0	0	8	31	0	39
Other	0	0	0	0	0	12	0	0	12
TOTAL	93	0	0	33	697	678	71	6	1,578

RED LINE EXTENSION TO ALEWIFE: BEFORE/AFTER STUDY
CONTINUING USERS: DAVIS: ACCESS MODE BY PREVIOUS ACCESS MODE

	Drove Alone	Drove w/oth	Rode w/ oth	Dropped off	MBTA bus	Walked	Bicycled	Other	Total
Drove Alone	14	0	0	0	54	7	0	0	75
Drove w/others	0	0	0	0	20	0	0	0	20
Rode w/others	0	0	0	0	0	0	0	0	0
Dropped off	0	0	0	7	54	6	0	0	67
MBTA bus	0	0	0	0	329	14	6	0	349
Non-MBTA bus	0	0	0	0	0	0	0	0	0
Walked	8	4	0	7	664	112	4	0	799
Bicycled	0	0	0	0	5	0	0	0	5
Other	0	0	0	0	0	0	0	0	0
TOTAL	22	4	0	14	1,126	139	10	0	1,315

RED LINE EXTENSION TO ALEWIFE: BEFORE/AFTER STUDY
CONTINUING USERS: ALEWIFE: ACCESS MODE BY PREVIOUS ACCESS MODE

	Drove Alone	Drove w/oth	Rode w/ oth	Dropped off	MBTA bus	Walked	Bicycled	Other	Total
Drove Alone	79	20	9	8	158	3	0	0	276
Drove w/others	17	15	0	0	55	0	0	0	87
Rode w/others	0	17	0	0	0	0	0	0	17
Dropped off	3	0	0	31	134	10	0	0	178
MBTA bus	3	0	0	6	1075	12	0	0	1,096
Non-MBTA bus	0	0	0	0	3	0	0	0	3
Walked	13	0	0	0	244	20	3	0	280
Bicycled	0	0	0	0	0	3	0	0	3
Other	0	0	0	0	0	0	0	6	6
TOTAL	116	52	9	44	1,669	47	3	6	1,946

APPENDIX F
CHANGES IN BUS BOARDINGS

Route 62 Prior to the re-routing of Route 62 to Alewife Station, most Route 62's 590 daily riders transferred to and from Route 77 at Arlington Heights (up to 69 percent). Of these, approximately 150 trips also involved another transfer to or from the Red Line.

Since the re-routing to Alewife, ridership has increased to 950 trips per day, with most trips now being made to the Red Line at Alewife (650). In total, 490 additional trips are now being made to the Red Line on Route 62 than before the extension, however, up to 135 of these additional trips are a shift from Route 67. Transfers to and from Route 77 are down to 160 per day, a decrease of 250, due to the easier Red Line connection at Alewife.

Route 67 Prior to the Red Line extension, Route 67 operated between Five Forks in Lexington and Arlington Center. Ridership was very low (190 trips per day), with the route serving a very transit dependent market (87 percent of all riders had no car available). Most trips were to and from Arlington Center, where most riders walked to and from the bus (60 percent). Approximately 50 transferred to Route 77, 30 of whom also transferred to or from the Red Line.

With the restructuring of the route to operate between Turkey Hill and Alewife, ridership has increased to 730, and transfers to and from the Red Line have increased by 440 to 470 trips per day. Most riders on the old segment of the route between Five Forks and Lexington Center can now access the Red Line more directly via Routes 62 or 76, but trips to Arlington Center now require one or more transfers. Twenty persons between Lexington Center and Turkey Hill are no longer served. Due to improved connections with the Red Line, transfers to Route 77 are down to less than 20 per day.

Route 76 Since the re-routing of Route 76 from Harvard to Alewife, ridership has decreased from 950 trips per day to 850 per day, with most of the declines occurring at the ends of the route. Along the outer end of the route, 45 ex-riders (accounting for 90 trips) now instead drive to Alewife, while at the inner end of the route, 140 ex-riders are now within walking distance of the Red Line extension. In addition, 45 ex-riders now drive to or are dropped off at Alewife or Davis.

There have also been shifts in ridership from Route 76 to Routes 62 and 77. The shift of up to 135 riders to Route 62 has occurred in the vicinity of Lexington Center where increased service on Route 62 provides another transit option to the Red Line. Before the extension, only Route 76 directly connected with the Red Line (at Harvard); now both Route 62 and 76 operate between Lexington Center and the Red Line at Alewife. Although Route 76 has a slightly shorter running time, the difference is small enough (3 to 5 minutes) so that most passengers will take the first bus.

The shift to Route 77 (up to 80 trips per day), has occurred along Massachusetts Avenue. Before the extension and re-routing of Route 76, approximately 80 trips per day were made on the segment between Alewife Brook Parkway and Harvard Square. Almost all of these riders were on Route 76 only because it was the first bus to arrive at their stop enroute to Harvard Square and therefore have presumably not been significantly inconvenienced by the change to Route 76.

In spite of the overall decline in ridership, the number of trips made to and from the Red Line on Route 76 has increased by 270 from 340 to 610 per day. Of these, approximately 80 represent trips where transfers have been imposed by the re-routing on persons who previously rode Route 76 but did not transfer to the Red Line. The remaining 190 trips represent new trips[1] made on Route 76 to the Red Line.

Route 77/77A Although the routings of Routes 77 and 77A have not been changed since the opening of the extension, service has been reduced and ridership has delined from 17,890 to 11,250 trips per weekday. Ridership on Variation 77 is down 30 percent; on 77A, ridership is down 62 percent. The decline on both variations has been caused primarily by diversion of passengers to the Red Line extension and Route 79, and fewer transfers from other routes that have been extended to Alewife.

Prior to the extension, 41 percent of all trips (7310) on Route 77 were to and from the Red Line. Now, 1135 persons who used to use Route 77 to access the Red Line (accounting for 2,270 daily trips) are within walking distance of the Red Line and no longer use Route 77 (most of these passengers previously used 77A). In addition, the institution of service of Route 79, which is essentially a variation of Route 77 operating between Arlington Heights and Alewife, now provides quicker connections to the Red Line than does Route 77. As a result, 2,260 riders, almost all of whom previously rode Route 77 to and from the Red Line, now use Route 79 instead.

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[1] "New" trips refer to new trips on the particular route, and not necessarily to new transit trips.

A significant number of riders have also shifted from Route 77 to driving to or being dropped off at Alewife or Davis Stations. In total, 260 ex-Route 77 riders accounting for 520 daily trips have shifted to these modes. Also, as previously mentioned, there are now 290 fewer transfers from Routes 62 and 67 to and from the Red Line via Route 77. In total, the number of transfers from Route 77 to and from the Red Line has decreased by 5,020 from 7,310 to 2,290 per weekday.

Route 78 As with Route 77, Route 78 has also remained unchanged in alignment, but has experienced significant ridership losses due to diversion to the Red Line and to other routes operating to Alewife. Since the opening of the extension, ridership on Route 78 has declined from 2040 to 1570 per weekday. All of the loss appears to be due to a decline in transfers to the Red Line at Harvard (from 1080 to 620 per day). However, based upon survey data, this decline has not resulted in corresponding increases in ridership on Routes 62, 67 or 84 (which now serve most of the same area but now offer faster connections to the Red Line at Alewife), or in increased access to Alewife by automobile, and remains unexplained.

Route 79 Service on Route 79 began following the Red Line extension to provide better connections to the Red Line to then Route 77 passengers from Arlington. Ridership on the route is approximately 2,010 per weekday, with 90 percent of all trips involving a transfer with the Red Line. Almost all Route 79 riders previously used Route 77; less than 10 previously drove to work.

Based on an MBTA evaluation of Route 77 and Route 79 service,[2] Route 79 carries 73 percent more trips to the Red Line than does Route 77 in the inbound direction (690 AM peak inbound on Route 79 versus 400 on Route 77). However, the savings in travel time to the Red Line on Route 79 is slight, so that only 21 percent of Route 79's riders would pass up a Route 77 bus if it arrived first. In the outbound direction, ridership from the Red Line to Arlington is split fairly evenly between Route 77 and Route 79. The cause of the apparent preference for Route 79 only in the AM Peak could not be determined from the survey data.

Route 83 Route 83 continues to operate between Rindge Avenue in North Cambridge and Central Square, as it did before the Red Line extension. Most of the area served by

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[2] "An Evaluation of Bus Service Along Massachusetts Avenue in Arlington", MBTA Service Planning Office, December 1986.

Route 83 is now also within walking of one of the new Red Line Stations, and since the opening of the extension, ridership has declined by 32 percent from 3,822 to 2,599 trips per weekday.

Most of the ridership loss is due to diversion of ridership to the Red Line. Prior to the extension, 1000 trips per day on Route 83 involved a transfer to or from the Red Line at Central Square. Now, persons making 860 of these trips walk directly to Alewife, Davis or Porter, and approximately 140 transfers are now made between Route 83 and the Red Line at Porter. Since counts were not conducted at Central, the number of transfers that continue to be made at that station is not precisely known. However, since much of the segment of the route on Beacon Street beyond Porter Square is more that one-half mile walking distance of Porter, Harvard or Central, it is likely that most riders boarding inbound on this segment that previously used Route 83 as feeder service continue to do so. In the Fall of 1983, riders boarding and alighting on this segment of the route made 110 transfers per day to and from the Red Line.

Route 84 Overall ridership on Route 84 has remained essentially unchanged since re-routing to Alewife, up less than 3 percent from 1020 to 1050 trips per day. However, the number of line-haul trips has declined from 590 to 380 per day, while the number of transfers to the Red Line has increased from 430 to 670 per day. For trips to and from the Red Line, up to 70 ex-Route 84 riders now drive or are droppped off at Alewife or Davis. Further, some of the increase in Red Line transfer trips (50) has occurred due to the imposition of a transfer on trips to locations between Alewife and Harvard that previously could be made entirely on Route 84. However, after taking into account these factors, the re-routing to Alewife and the extension have attracted up to 260 new trips daily. Most of the decrease in local trips has occurred on the segment between Alewife and Harvard, where up to 330 ex-riders can now directly access the Red Line.

Route 87 Since the extension of Route 87 to Arlington Center and the extension of the Red Line to Alewife, ridership on Route 87 has increased by 17 percent from 3,580 to 4,180 passenger trips per weekday. Of the 600 new trips, most (470) are to and from the Red Line at Davis, with the remainder being new trips unrelated to the Red Line extension. Most trips continue to be to and from locations in Somerville and to and from the Green Line. However, up to 200 persons that previously rode Route 87 to the Green Line at Lechmere now directly access the Red Line at Davis or Porter, and no longer use Route 87.

Route 88 Route 88, like Route 87, acts primarily as a line-haul route through Somerville and as a feeder route to the Green Line at Lechmere. Since the opening of the Red Line extension and the reduction of service on Route 88, ridership has declined by 560 trips per day to 4800. Much of the loss is the result of ex-Route 88 riders walking to the Red Line instead of riding Route 88 to the Green Line (410). Six hundred and ten riders now transfer to and from the Red Line at Davis. Of these, 90 previously transfered at Lechmere to the Green Line, but the other 320 trips appear to have been induced by the Red Line extension.

Route 89 Although Route 89, which operates between Clarendon Hill and Sullivan, does not connect with the Red Line, persons who previously rode Route 89 now access the Red Line either through walking or on other bus routes. As a result, ridership on Route 89 has declined since the opening of the extension. Of a total loss of 440 trips per day, up to 350 have been caused by persons that now walk directly to the Red Line, and 60 by those who now ride other bus routes to Davis (presumably Routes 87 and 88).

Route 94 Route 94 began operation shortly following the opening of the extension as a replacement for Route 96A, which was discontinued. Ridership on this route is estimated at 1,270 per weekday, with most riders being ex-Route 96 or 96A riders. Approximately 57 percent (720) of these trips involve a transfer with the Red Line at Davis Square. Of these, 630 are made by riders that previously rode Route 96 or 96A (see below), and 90 are new trips that have been generated by the new route and Red Line extension.

Route 96 Route 96 now operates between Medford Square and Harvard Station only via George Street, with the South Street variation (96A) having been replaced by Route 94. As a result of this change and the Red Line extension, ridership on Route 96 has decreased from 4,947 to 2,617 trips per weekday. Most of the loss in ridership is attributable to shifts in ridership to Route 94, by former transfer riders who can now walk directly to the Red Line (460 trips), former line-haul passengers who now use the Red Line instead (430 trips), and by riders who drive or are dropped at Alewife or Davis (120 trips).

Although there are 480 daily transfers to and from the Red Line at Davis, most ridership continues to be of a line-haul nature to and from the vicinity of Harvard Square. Since these trips are not directly served by Route 94 (which terminates at Davis), most non-Red Line ridership is on Route 96 (2,140 daily trips versus 550 on Route 94). Up to 65 percent of those who continue to use feeder bus service to access the Red Line have shifted to Route 94 (615 daily trips). This large shift from Route 96 to Route 94 is probably due to lighter ridership and less crowded buses on

Route 94.

On Routes 96 and 94 combined, the total number of transfers with the Red Line has declined from 1410 per day to 1200 per day. Included in this decline are 460 trips that continue to be made, but by those who now walk directly to the Red Line. Taking these trips into account, combined services on Routes 94 and 96 and the Red Line extension now serve 260 new daily trips.

Route 350 Since the re-routing of Route 350 into Alewife, ridership has declined 8 percent from 1,590 to 1,460 trips per weekday. Prior to the extension, most riders (64 percent, involving 930 trips) traveled to or from Boston and slightly less than 22 percent of all trips (350) involved a transfer with the rapid transit system (at Kendall or Haymarket). With the present re-routed service, there are 890 daily transfers with the Red Line at Alewife, indicating a decrease in the number of trips to Cambridge and Boston. The number of local/non-rapid transit trips made on Route 350 has also declined from 660 trips per day to 570 trips per day, due to the elimination of service between Alewife Brook Parkway and Haymarket.

Table F-1
Summary of Before/After Operating and Ridership Statistics

	Weekday Operating Statistics				Weekday Costs, Ridership, Revenues			Weekday Performance Statistics			
	Round Trips	Vehicle Requirement	Vehicle Service Hours	Vehicle Service Miles	Ridership (Unlinked Trips)	Operating Cost	Farebox Revenue	Net Cost/ Passenger	Farebox Return	Passengers/ Veh Ser Hr	Passengers/ Peak Vehicles
RED LINE EXT											
Before	0	0	0	0.0	0	$0	$0	NA	NA	NA	
After	221	124	59	2,426.5	19,900	$16,286	$10,149	$0.31	62.32%	338.30	
% Change					NA	NA	NA	NA	NA	NA	
Route 62											
Before	16	2	16.0	263.5	587	$959	$232	$1.24	24.19%	36.78	293.50
After	21	3	28.6	506.2	954	$1,734	$395	$1.40	22.79%	33.38	318.00
% Change	37.7%	50.0%	79.1%	92.1%	62.5%	80.9%	70.4%	13.4%	-5.8%	-9.3%	8.3%
Route 67											
Before	7	1	8.0	121.8	193	$462	$57	$2.10	12.22%	24.25	193.00
After	24	2	18.9	169.3	726	$873	$258	$0.85	29.57%	38.51	363.00
% Change	235.9%	100.0%	136.9%	39.0%	276.2%	88.8%	356.6%	-59.7%	141.9%	58.8%	88.1%
Route 76											
Before	18	4	36.0	547.2	947	$2,050	$590	$1.54	28.76%	26.31	236.75
After	22	3	34.6	113.4	854	$1,719	$407	$1.54	23.68%	24.67	284.67
% Change	20.4%	-25.0%	-3.8%	-79.3%	-9.8%	-16.1%	-31.0%	-0.4%	-17.7%	-6.2%	20.2%
Route 77											
Before	166	23	183.5	1820.5	13,991	$9,025	$5,009	$0.29	55.50%	76.23	608.30
After	134	10	159.2	1538.9	9,793	$7,082	$3,506	$0.37	49.51%	61.53	979.30
% Change	-19.1%	-56.5%	-13.3%	-15.5%	-30.0%	-21.5%	-30.0%	27.2%	-10.8%	-19.3%	61.0%
Route 77A											
Before	114	4	60.6	410.4	4,357	$2,419	$1,558	$0.20	64.41%	71.90	1089.25
After	91	4	42.1	315.4	1,656	$1,815	$592	$0.74	32.63%	39.30	414.00
% Change	-20.5%	0.0%	-30.5%	-23.1%	-62.0%	-25.0%	-62.0%	273.7%	-49.3%	-45.3%	-62.0%
Route 78											
Before	47	4	46.5	437.1	2,037	$2,122	$723	$0.69	34.05%	43.81	509.25
After	47	4	47.0	528.3	1,569	$2,285	$557	$1.10	24.35%	33.37	392.25
% Change	1.4%	0.0%	1.1%	20.9%	-23.0%	7.7%	-23.0%	60.4%	-28.5%	-23.8%	-23.0%
Route 79											
Before	NS	0	0.0	0.0	0	$0	$0	NA	NA	NA	NA
After	72	7	60.7	521.5	2,005	$2,810	$709	$1.05	25.23%	33.03	3.84
% Change	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Route 83											
Before	52	6	52.0	374.4	3,822	$2,288	$1,490	$0.21	65.15%	73.50	637.00
After	51	6	60.1	354.9	2,599	$2,451	$1,014	$0.55	41.36%	43.27	433.17
% Change	-1.1%	0.0%	15.5%	-5.2%	-32.0%	7.1%	-32.0%	165.1%	-36.5%	-41.1%	-32.0%
Route 84											
Before	25	4	25.0	345.0	1,023	$1,449	$360	$1.06	24.84%	40.92	255.75
After	38	2	21.0	339.9	1,054	$1,207	$371	$0.79	30.72%	50.23	527.00
% Change	51.1%	-50.0%	-16.1%	-1.5%	3.0%	-16.7%	3.0%	-25.5%	23.7%	22.8%	106.1%
Route 87											
Before	63	5	63.0	516.6	3,582	$2,721	$1,190	$0.43	43.73%	56.86	716.40
After	55	5	65.5	530.2	4,177	$2,803	$1,387	$0.34	49.50%	63.82	835.40
% Change	NA	NA	NA	NA	16.6%	3.0%	16.6%	-20.7%	13.2%	12.2%	16.6%
Route 88											
Before	77	9	71.3	657.9	5,360	$3,429	$1,827	$0.30	53.28%	75.18	595.56
After	64	7	48.3	507.4	4,804	$2,487	$1,637	$0.18	65.85%	99.46	686.29
% Change	-18.3%	-22.2%	-32.3%	-22.9%	-10.4%	-27.5%	-10.4%	NA	NA	NA	NA

Table F-1
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	Weekday Operating Statistics				Weekday Costs, Ridership, Revenues			Weekday Performance Statistics			
	Round Trips	Vehicle Requirement	Vehicle Service Hours	Vehicle Service Miles	Ridership (Unlinked Trips)	Operating Cost	Farebox Revenue	Net Cost/ Passenger	Farebox Return	Passengers/ Veh Ser Hr	Passengers/ Peak Vehicles
Route 89											
Before	70	6	60.6	472.6	5,070	$2,657	$1,725	$0.18	64.90%	83.73	845.00
After	65	8	55.2	397.8	4,627	$2,403	$1,574	$0.18	65.50%	83.90	771.17
% Change	-7.2%	0.0%	-8.9%	-15.8%	-8.7%	-9.6%	-8.7%	-2.6%	0.9%	0.2%	-8.7%
Route 94											
Before	NS	0	0.0	0.0	0	$0	$0	NA	NA	NA	NA
After	53	3	45.1	450.5	1,270	$2,042	$512	$1.20	25.08%	28.17	423.33
% Change	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Route 96											
Before	73	8	105.8	525.6	4,947	$3,977	$1,994	$0.40	50.14%	46.74	818.38
After	48	5	55.5	108.0	2,617	$2,257	$1,055	$0.46	48.75%	47.15	523.40
% Change	-34.2%	-37.5%	-47.6%	-79.5%	-47.1%	-43.3%	-47.1%	14.5%	-6.8%	0.9%	-15.4%
Route 350											
Before	32	9	87.3	957.6	1,594	$3,829	$1,066	$1.73	27.84%	23.67	177.11
After	33	6	57.1	656.8	1,464	$2,879	$631	$1.54	21.93%	25.62	244.00
% Change	4.7%	-33.3%	-15.1%	-31.4%	-8.2%	-24.8%	-40.8%	-11.4%	-21.2%	8.2%	37.8%
BUS TOTALS											
Before	757	85	796	7,450.2	47,510	$37,387	$17,819	$0.41	47.66%	59.72	558.94
After	817	73	799	7,038.5	40,169	$36,846	$14,605	$0.55	39.64%	50.29	550.26
% Change	8.0%	-14.1%	0.4%	-5.5%	-15.5%	-1.4%	-18.0%	34.4%	-16.8%	-15.8%	-1.6%
BUS & RED LINE											
Before	757	85	796	7,450.2	47,510	$37,387	$17,819	$0.41	47.68%	59.72	558.94
After	1038	197	858	9,464.9	80,069	$53,132	$24,754	$0.47	48.59%	70.05	304.92
% Change	37.1%	131.8%	7.8%	27.0%	28.4%	42.1%	38.9%	14.7%	-2.2%	17.3%	-45.4%

APPENDIX G
NEW RIDERSHIP AT ALEWIFE -

Most of the "after" data is based on ridership counts and a passenger survey conducted in April 1986. Since that time, use of the Alewife garage has continued to increase from less than 900 cars per day (pre-commuter rail strike) to over 1700 cars per day (in April 1987). To determine the characteristics of these new garage patrons, a follow-up survey was conducted in November 1986.

During the period April 1986 through November 1986, the Red Line initially gained approximately 370 parkers per day at Alewife as a result of the commuter rail strike (March - May 1986), when garage use jumped from an average of 870 parked cars per day to 1240. Immediately after the strike ended in May 1986, 160 of the commuter rail riders returned to commuter rail, but 210 continued to ride the Red Line. However, since that time, most of those riders have also stopped using the Red Line, with only 40 ex-commuter rail riders still parking in the garage by November 1986. Although the reason for the gradual shift back to commuter rail is not known for certain, it is likely that the lower cost of commuter rail was the major factor.[1]

While most of the commuter rail riders have returned to commuter rail since the strike, there has been continued growth by those whose trip patterns have changed. Excluding the commuter rail "shifters", parking garage useage has grown from 870 in April 1986, to 1460 in November 1986. Since both surveys (April and November) were designed to survey both continuing and new riders, it was not possible to specifically breakout the responses of those riders that have begun using the Red Line since April 1986. However, a comparison of the two surveys provides much of the same information.

In general, the second survey showed a greater percentage of users that previously did not make the same trip (58 percent, versus 45 percent), and a lower percentage of riders that shifted from other modes, as shown below:

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[1] Including parking charges at Alewife (approximately $60 per month), and the cost of a Zone B transit pass ($22 per month), the total monthly cost of Alewife services is $82 per month. At most commuter rail stations, parking is free, and the cost of commuter rail monthly passes for most riders in Zones 1 through 6 is $40 to $79 per month.

Table F-1
Comparision of Survey Results: April 1986 and November 1986
Alewife Station; Riders Parking in Garage

Prior Mode	April 1986	November 1986
Did Not Make Trip	36.1%	58.0%
Drove Alone	29.3%	18.7%
Car Pool	3.0%	2.7%
Bus	9.3%	7.3%
Commuter Rail	16.1%	6.0%
Walk	0.0%	0.7%
Orange or Green Line	6.2%	6.7%
Other	0.0%	0.0%
	100%	100%

The April figures reflect more of the immediate changes that continuing riders made as a result of the extension than do the November figures, while the November figures begin to show more of the impact of natural turnover in ridership. As a result, the November figures show a much higher proportion of riders that previously did not make the same trip, and lower percentages of riders who shifted from other modes. This was as expected since most persons who would shift from other modes would do so in the first year following the opening of the extension. From that time on, however, since most mode shifts have already been made, and in the absence of marketing or other promotional type efforts, most new trips will those made by persons whose travel patterns have recently changed.

APPENDIX H
CHANGES IN TRAFFIC VOLUMES - ALEWIFE AREA

TABLE H-1
ALEWIFE BEFORE/AFTER STUDY
SELECTED TRAFFIC COUNTS: ALEWIFE VICINITY

AM Peak Period (7:00 - 10:00)

	Before Alewife Station Opened	*After Alewife Station Opened*		*After Interim Access Done*		
APPROACHING INTERSECTION OF RTE 2/ALEWIFE BRK PKWY:	Mar. 1985	Nov. 1985	% Change	Oct. 1986	% Change	% Change 3/85 to 10/86
Rte. 2 EB	6,939	7,524	8%	9,488	26%	37%
Alwf Brk Pkwy SB	4,614	4,589	-1%	4,982	9%	8%
Alwf Brk Pkwy NB	4,621	4,865	5%	4,471	-8%	-3%
Ramp from garage	0	0	na	123	na	na
TOTAL	**16,174**	**16,978**	**5%**	**19,064**	**12%**	**18%**
Garage traffic*	0	*****	na	1,576	na	na
TOTAL: W/O GAR. TRAF.	**16,174**	na	na	**17,488**	na	**8%**
APPROACHING INTERSECTION OF RINDGE/ALEWIFE BRK PKWY:						
Camb Park Dr EB	216	323	50%	1,175	264%	444%
Alwf Brk Pkwy SB	6,740	7,652	14%	6,853	-10%	2%
Rindge Ave WB	1,439	1,503	4%	1,475	-2%	3%
Alwf Brk Pkwy NB	4,474	4,668	4%	4,484	-4%	0%
TOTAL	**12,869**	**14,146**	10%	**13,987**	**-1%**	**9%**
Garage traffic*	0	*****	na	325	na	na
TOTAL: W/O GAR. TRAF.	**12,869**	na	na	**13,662**	na	**6%**
TOTAL INTO ZONE**	**17,466**	**18,284**	5%	**20,429**	**12%**	**17%**
All Garage traffic into zone***	0	*****	na	1,576	na	na
Garage traffic new to zone****	0	*****	na	939	na	na
TOTAL W/O NEW GAR. TRAF.	**17,466**	na	na	**19,490**	na	**12%**

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* Garage traffic includes both park&ride and kiss&ride vehicles, and it includes both traffic going into and coming away from the garage.

** The zone is the area around Alewife Station that is entered by Route 2 eastbound, Alewife Brook Parkway northbound and southbound, and Rindge Avenue westbound.

*** Includes all garage traffic coming into the zone.

**** Includes only garage traffic that was not previously passing through zone on the way to Boston/Cambridge.

***** November 1985 garage traffic is unknown.

TABLE H-2
ALEWIFE BEFORE/AFTER STUDY
SELECTED TRAFFIC COUNTS: ALEWIFE VICINITY

PM Peak Period (3:30 - 6:30)

APPROACHING INTERSECTION OF RTE 2/ALEWIFE BRK PKWY:	*Before Alewife Station Opened* Mar. 1985	*After Alewife Station Opened* Nov. 1985	% Change	*After Interim Access Done* Oct. 1986	% Change	% Change 3/85 to 10/86
Rte. 2 EB	6,509	6,625	2%	6,889	4%	6%
Alwf Brk Pkwy SB	3,348	3,458	3%	3,500	1%	5%
Alwf Brk Pkwy NB	6,941	7,231	4%	6,564	-9%	-5%
Ramp from garage	0	0	na	670	na	na
TOTAL	16,798	17,314	3%	17,623	2%	5%
Garage traffic*	0	*****	na	858	na	na
TOTAL: W/O GAR. TRAF.	16,798	na	na	16,765	na	0%
APPROACHING INTERSECTION OF RINDGE/ALEWIFE BRK PKWY:						
Camb Park Dr EB	716	1,317	84%	1,714	30%	139%
Alwf Brk Pkwy SB	5,096	5,245	3%	4,727	-10%	-7%
Rindge Ave WB	1,506	1,566	4%	1,353	-14%	-10%
Alwf Brk Pkwy NB	6,535	6,133	-6%	6,067	-1%	-7%
TOTAL	13,853	14,261	3%	13,861	-3%	0%
Garage traffic*	0	*****	na	435	na	na
TOTAL: W/O GAR. TRAF.	13,853	na	na	13,426	na	-3%
TOTAL OUT OF ZONE**	18,315	18,478	1%	18,980	3%	4%
Garage traffic out of zone***	0	*****	na	1,018	na	na
Garage traffic new to zone****		*****	na	611	na	na
TOTAL W/O NEW GAR. TRAF.	18,315	na	na	18,369	na	0%

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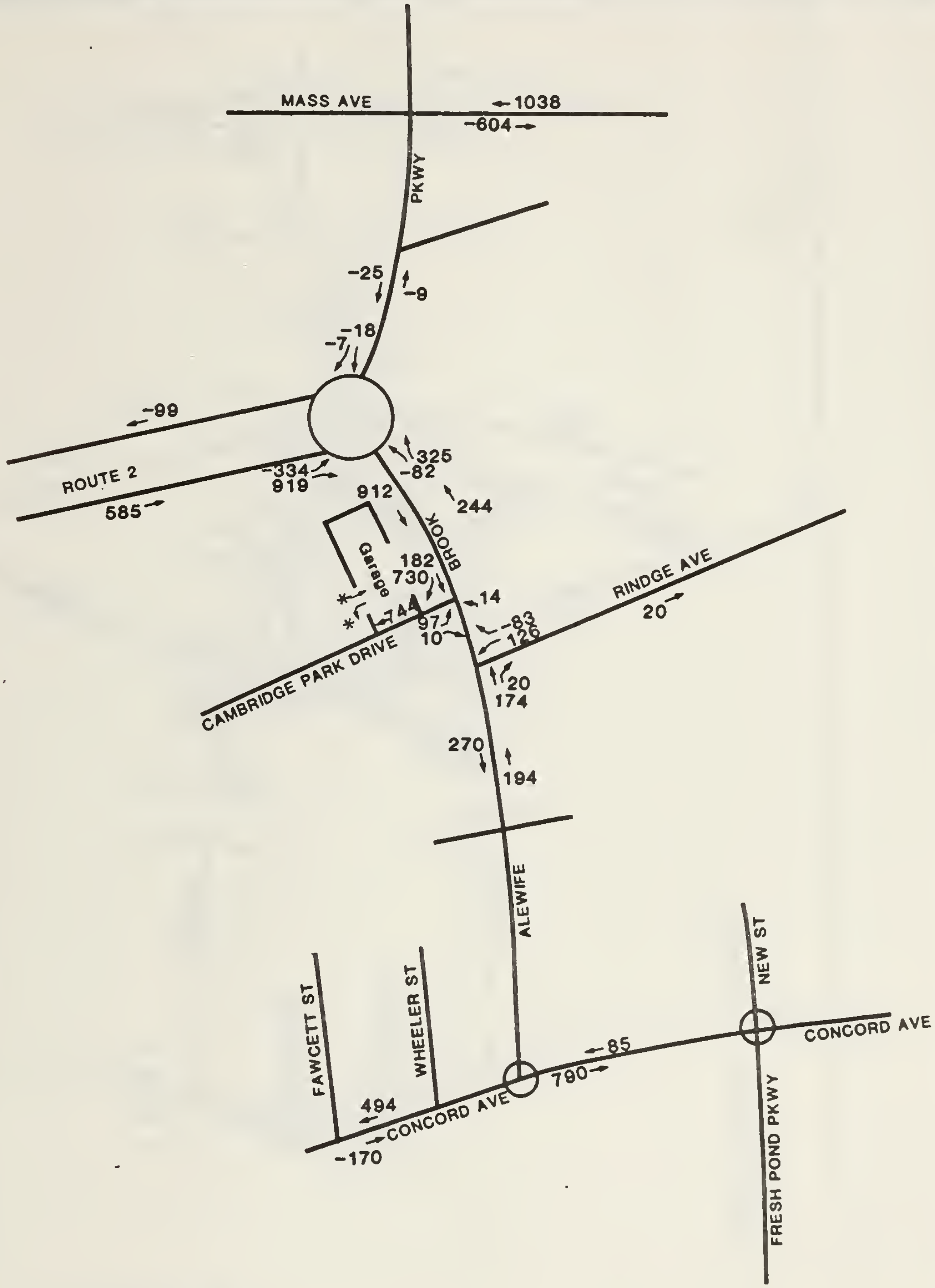
* Garage traffic includes both park&ride and kiss&ride vehicles, and it includes both traffic going into and coming away from the garage.

** The zone is the area around Alewife Station that is entered by Route 2 eastbound, Alewife Brook Parkway northbound and southbound, and Rindge Avenue westbound.

*** Includes all garage-induced traffic leaving the zone.

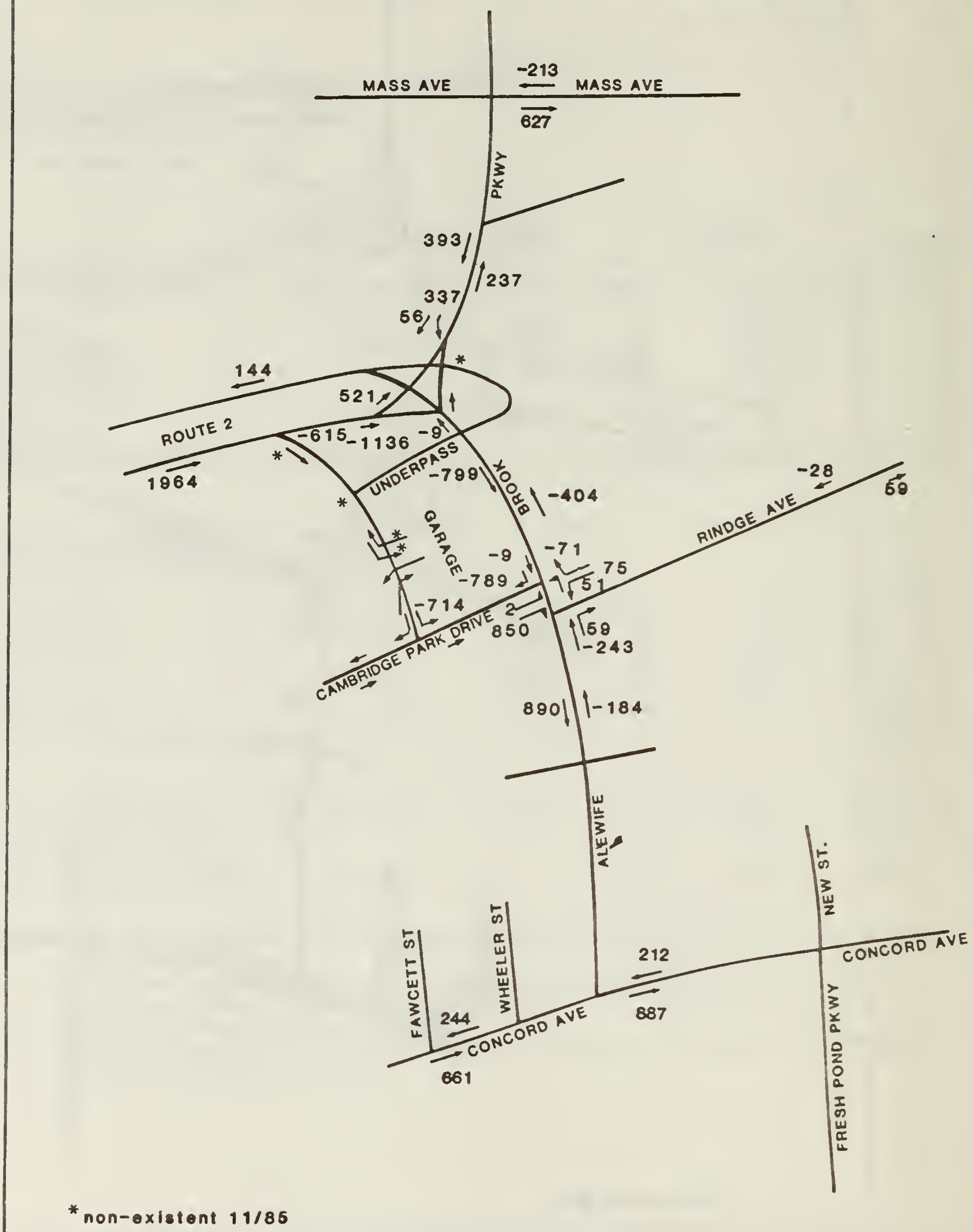
**** Includes only garage traffic that was not previously passing through zone on the way from Boston/Cambridge.

***** November 1985 garage traffic is unknown.



*non-existent, 3/85

Alewife Before/After Study	Weekday Traffic Volumes 7:00-10:00 a.m. Absolute Difference From March 1985 to November 1985	**CTPS**
December 1987		FIGURE H-3



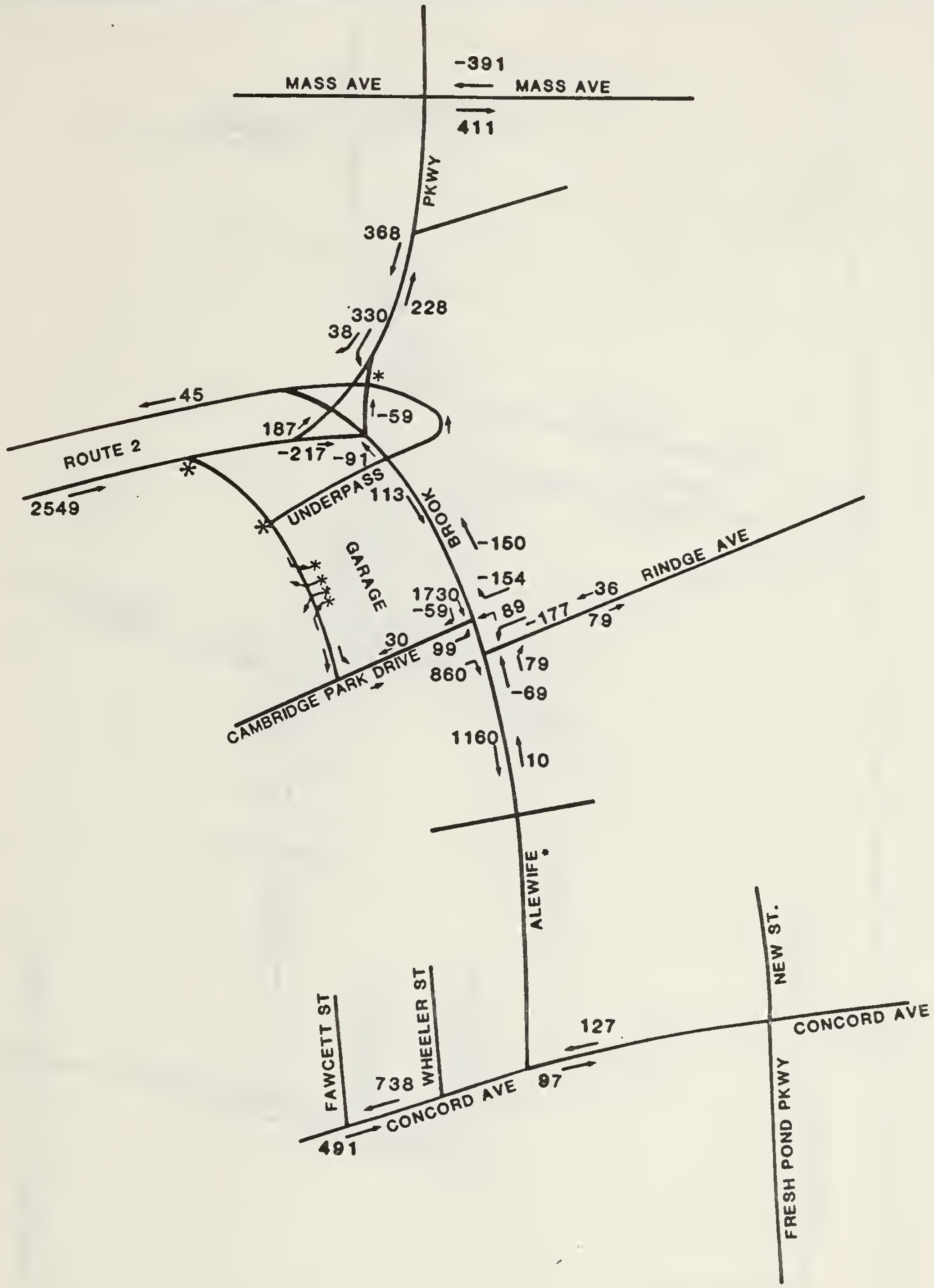
Alewife Before/After Study

December 1987

Weekday Traffic Volumes
7:00-10:00 a.m.
Absolute Difference
From November 1985 to October 1986

CTPS

FIGURE
H-4



*non-existent, 3/85

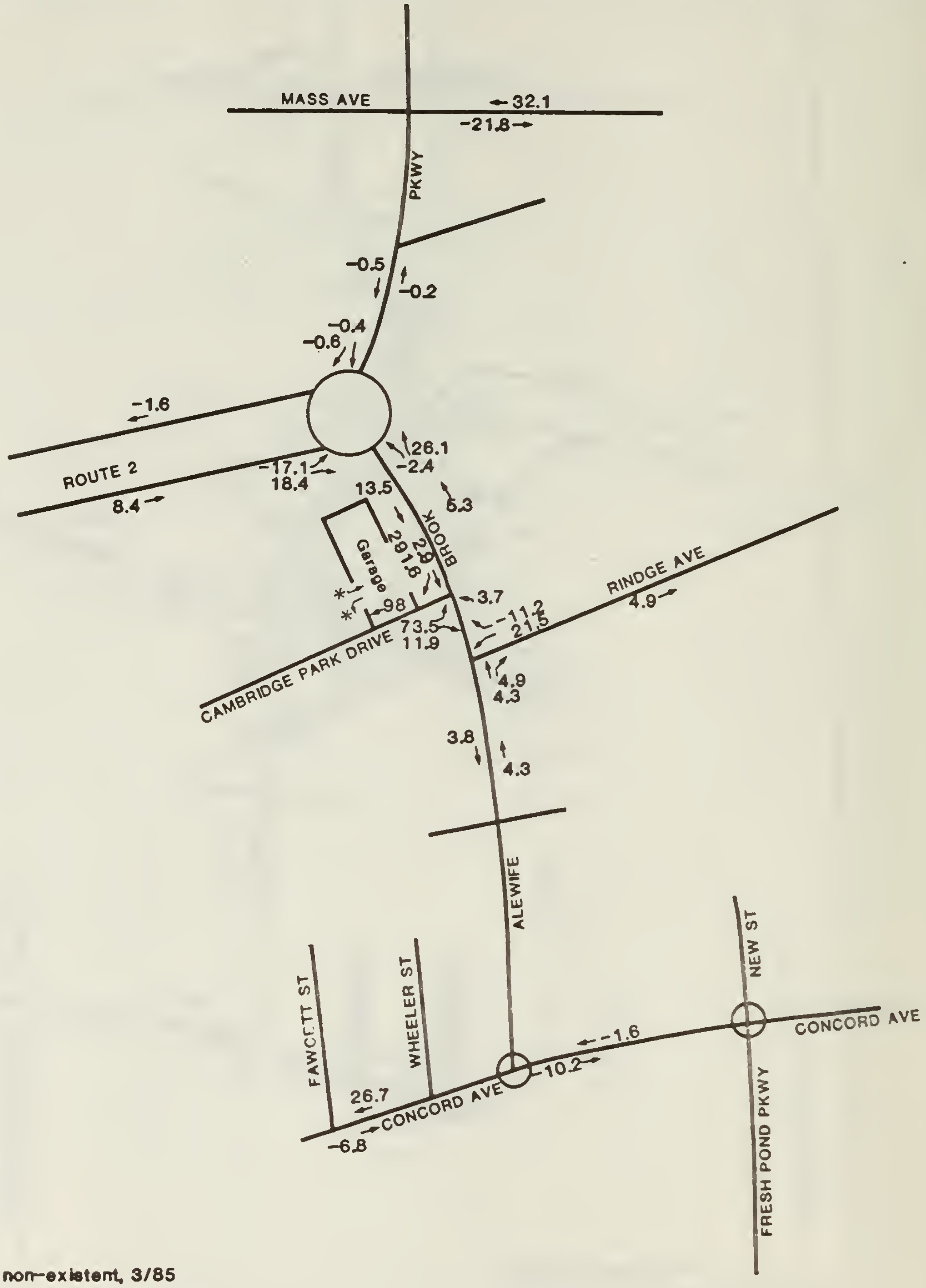
Alewife Before/After Study

December 1987

Weekday Traffic Volumes
7:00-10:00 a.m.
Absolute Difference
From March 1985 to October 1986

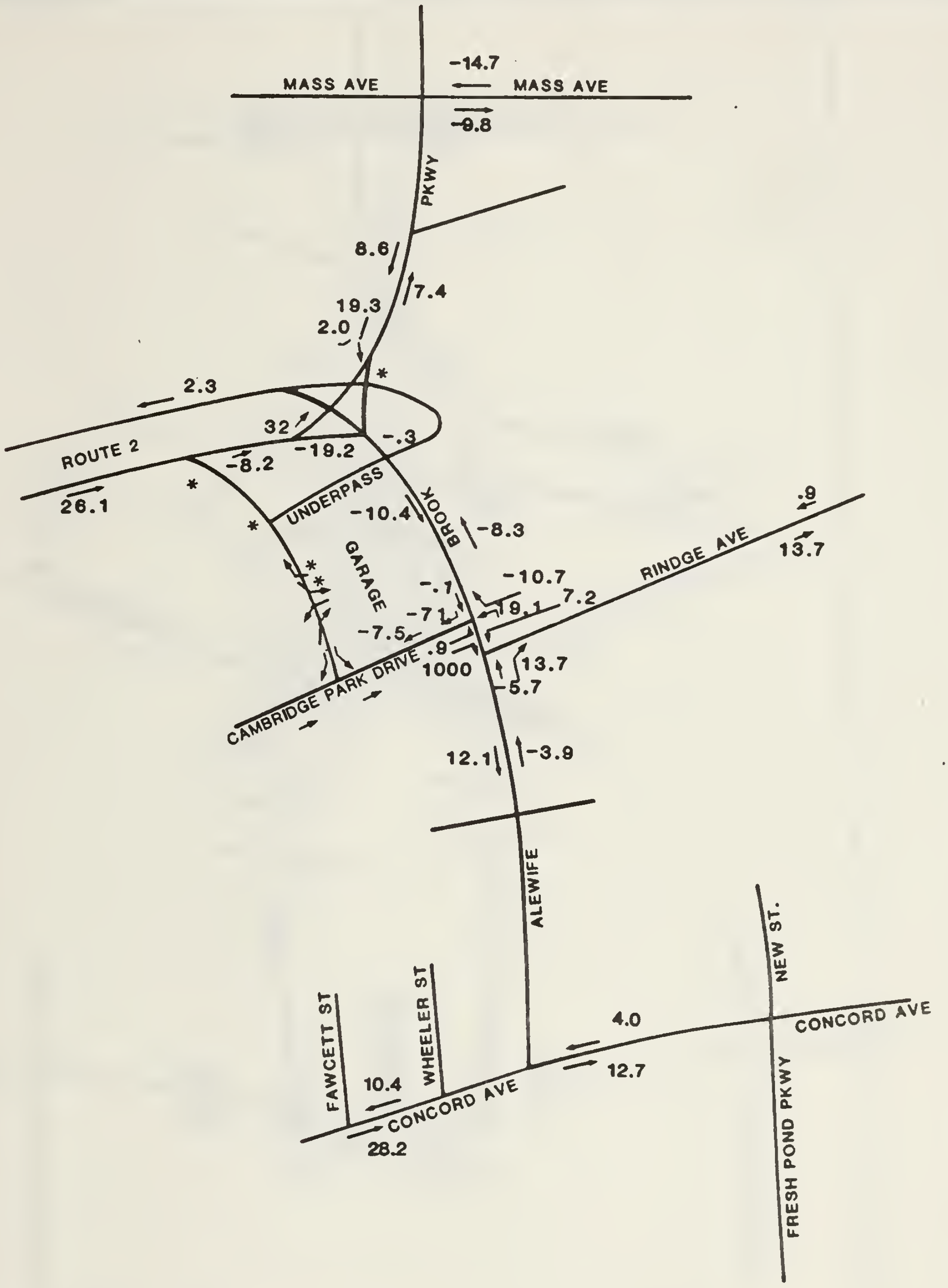
CTPS

FIGURE
H-5



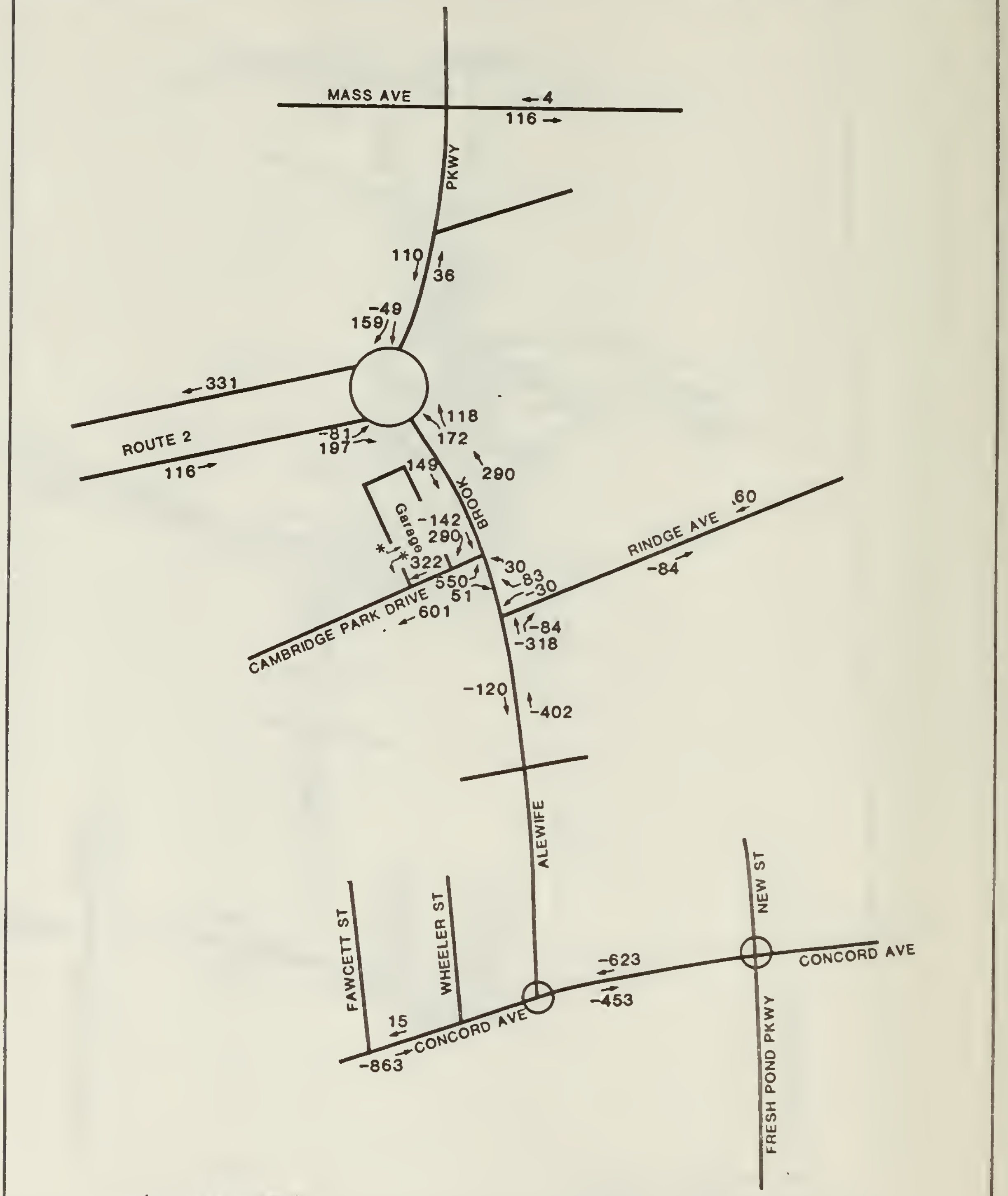
*non-existent, 3/85

Alewife Before/After Study December 1987	Weekday Traffic Volumes 7:00-10:00 a.m. % Change from March 1985 to November 1985	CTPS FIGURE H-6



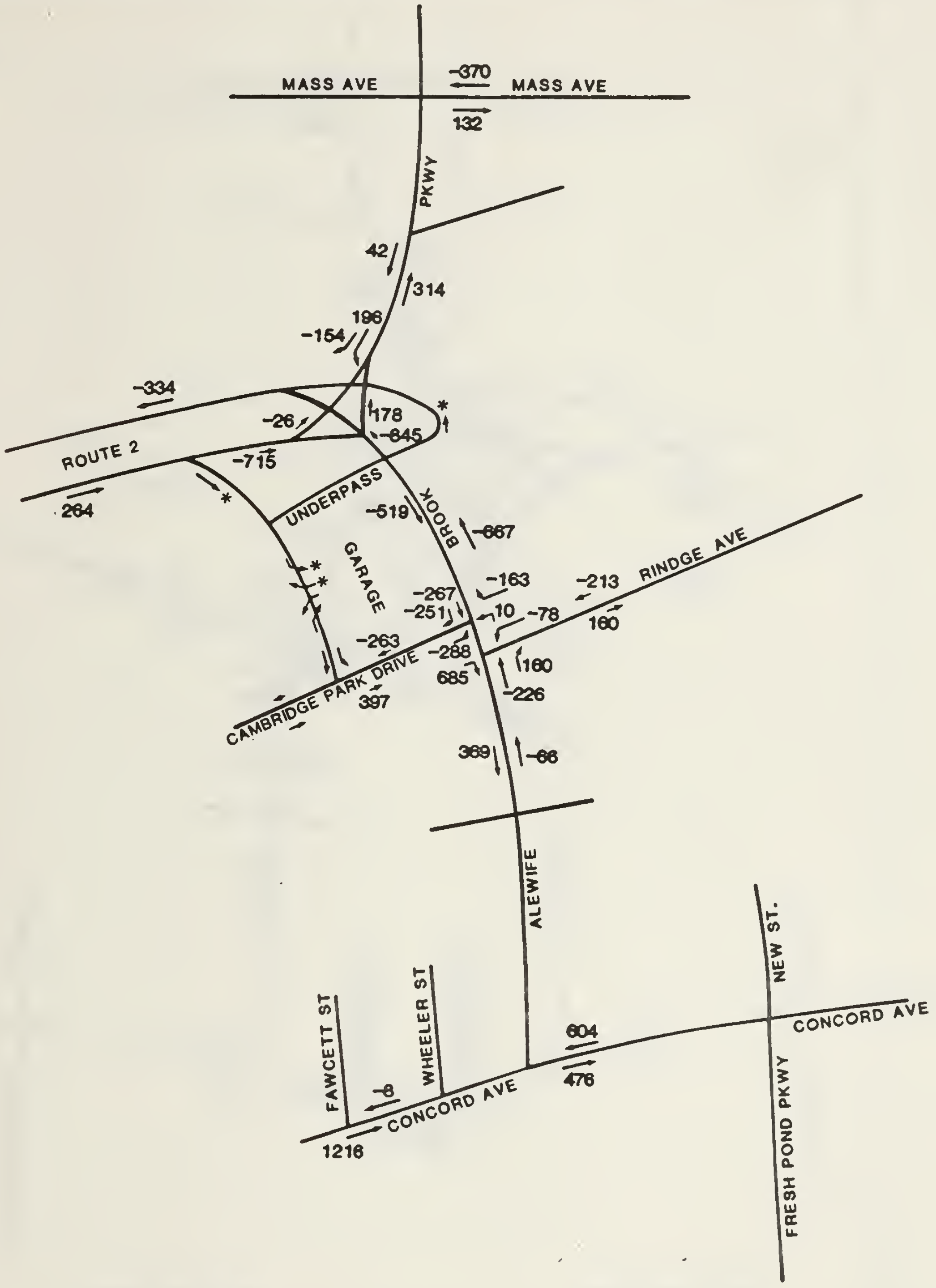
*non-existent 11/85

Alewife Before/After Study	Weekday Traffic Volumes 7:00-10:00 a.m. % Change From November 1985 to October 1986	**CTPS**
December 1987		FIGURE H-7



*non-existent, 3/85

Alewife Before/After Study	Weekday Traffic Volumes 3:30-6:30 pm Absolute Difference From March 1985 to November 1985	CTPS
December 1987		FIGURE H-8



*non-existent, 11/85

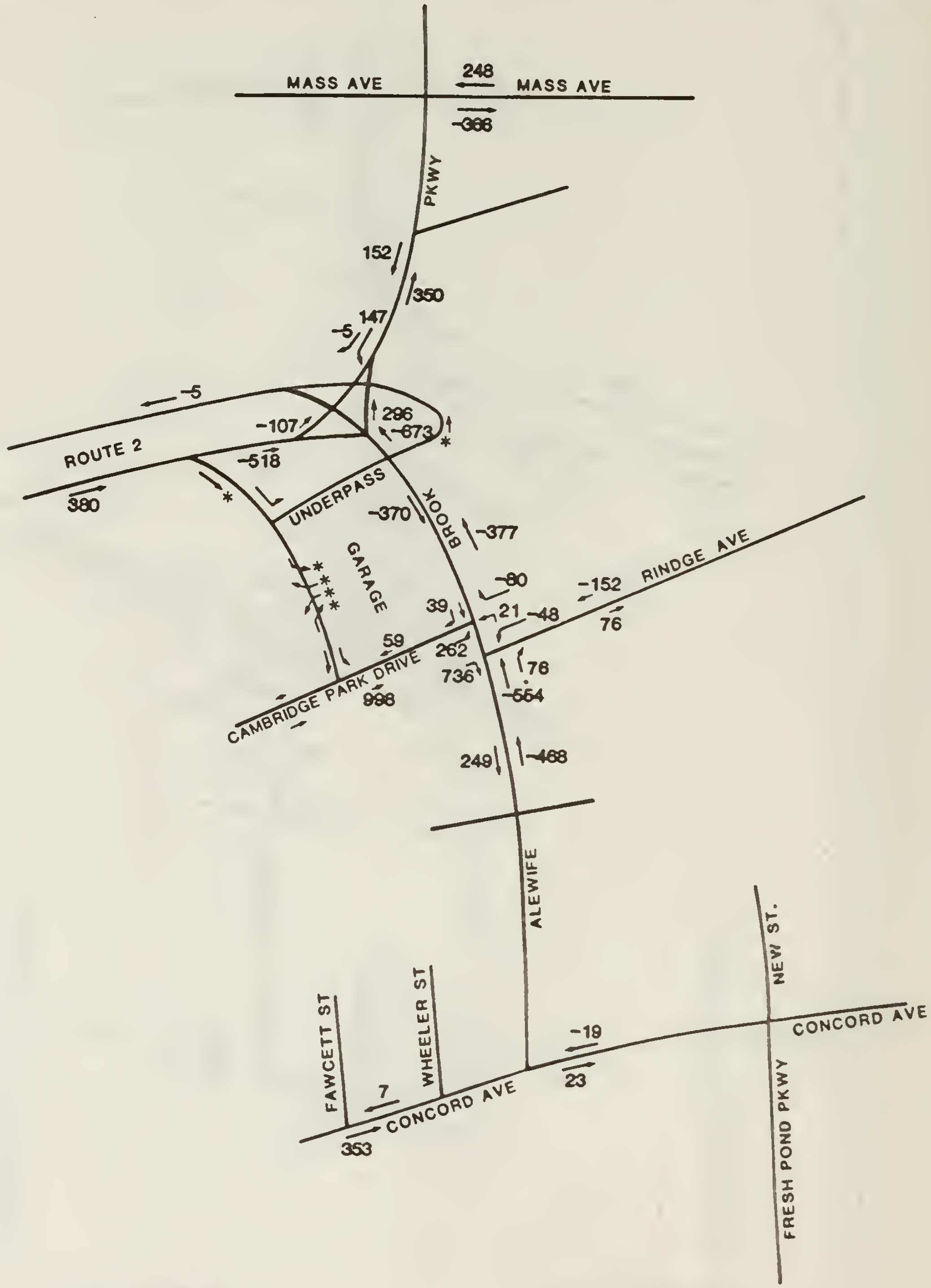
Alewife Before/After Study

December 1987

Weekday Traffic Volumes
3:30-6:30 p.m.
Absolute Difference
From November 1985 to October 1986

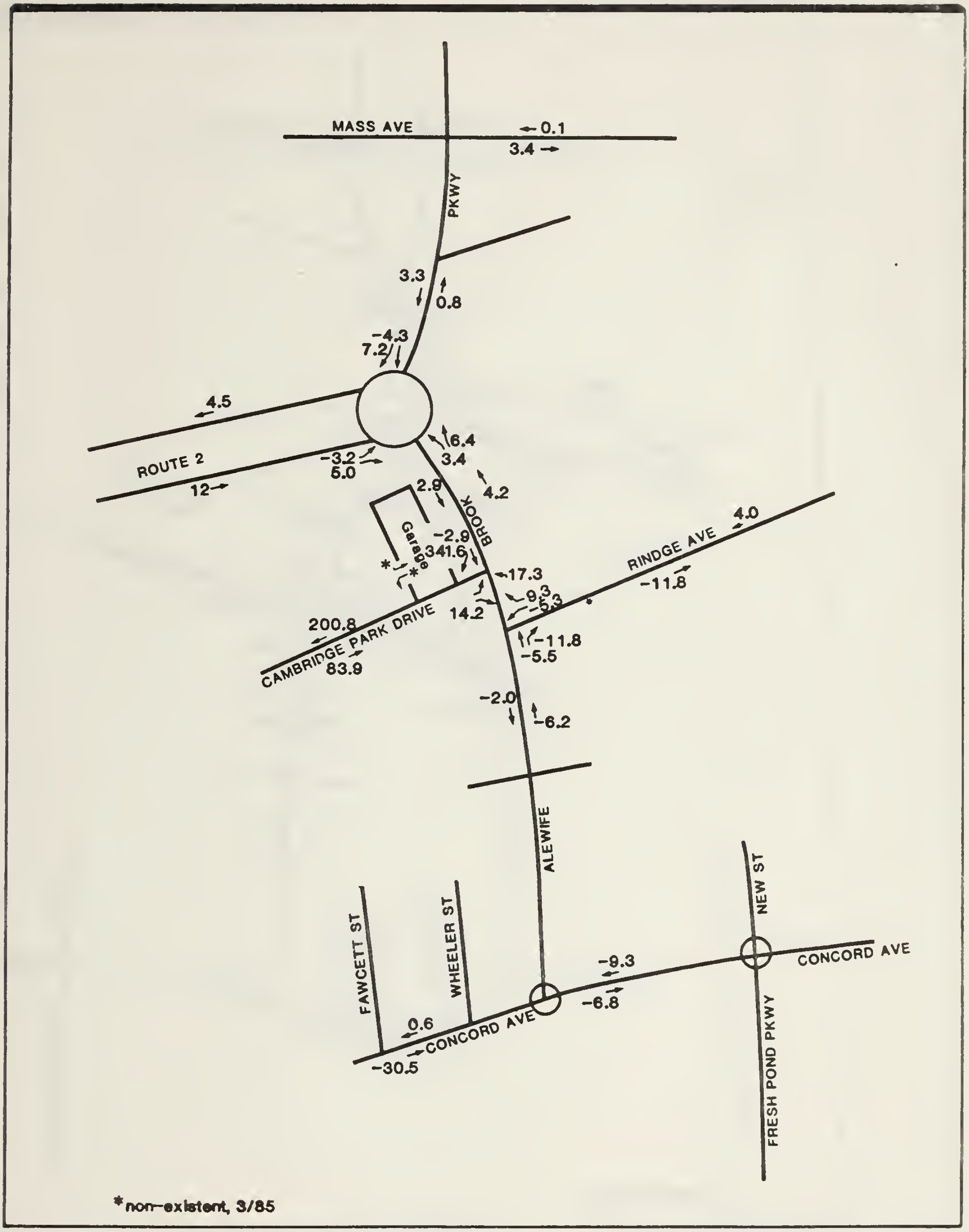
CTPS

FIGURE
H-9



* non-existent, 3/85

Alewife Before/After Study	Weekday Traffic Volumes 3:30-6:30 pm Absolute Difference From March 1985 to October 1986	**CTPS**
December 1987		FIGURE H-10



*non-existent, 3/85

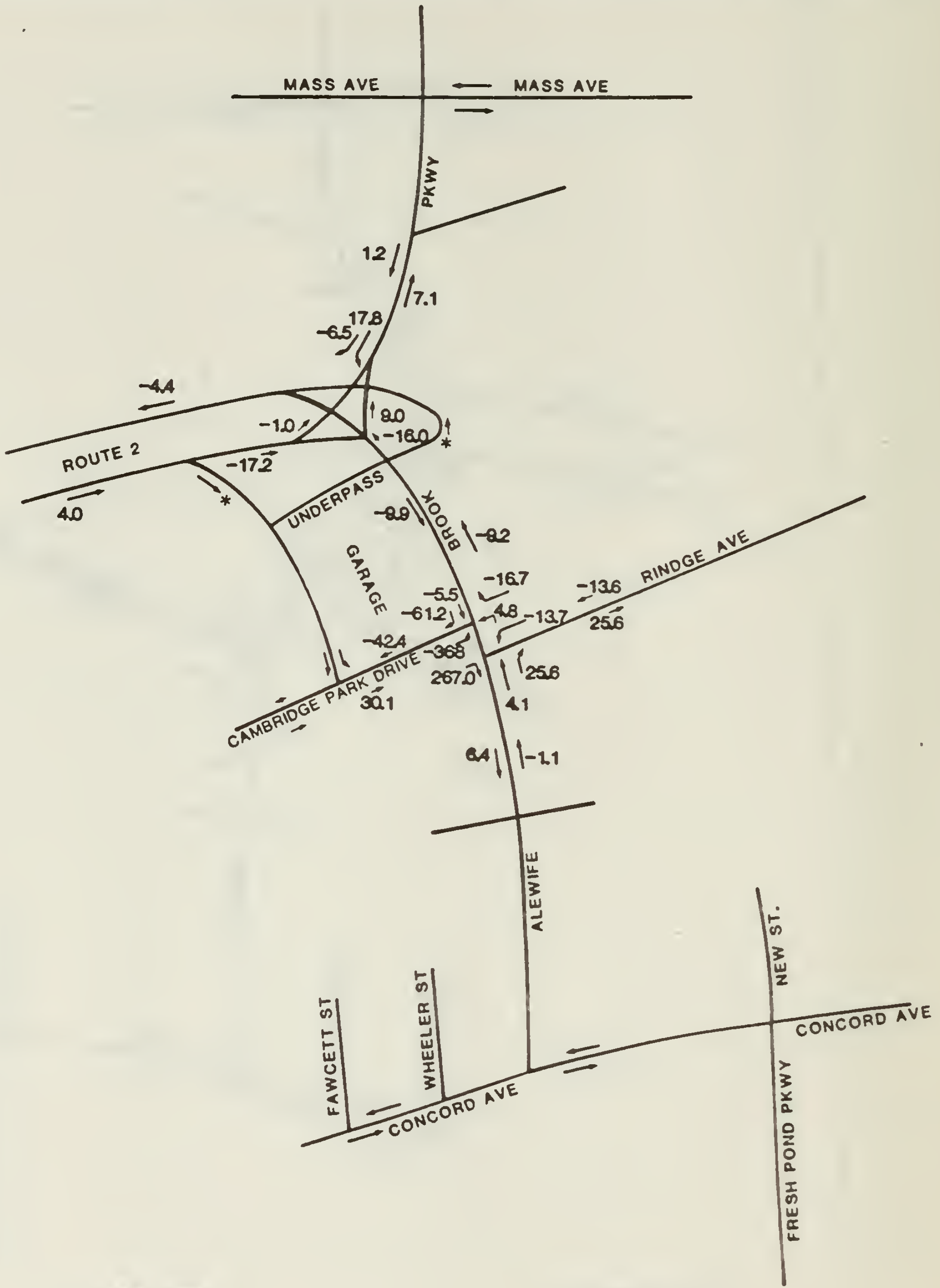
Alewife Before/After Study

December 1987

Weekday Traffic Volumes
3:30-6:30 p.m.
%Change
From March 1985 to November 1985

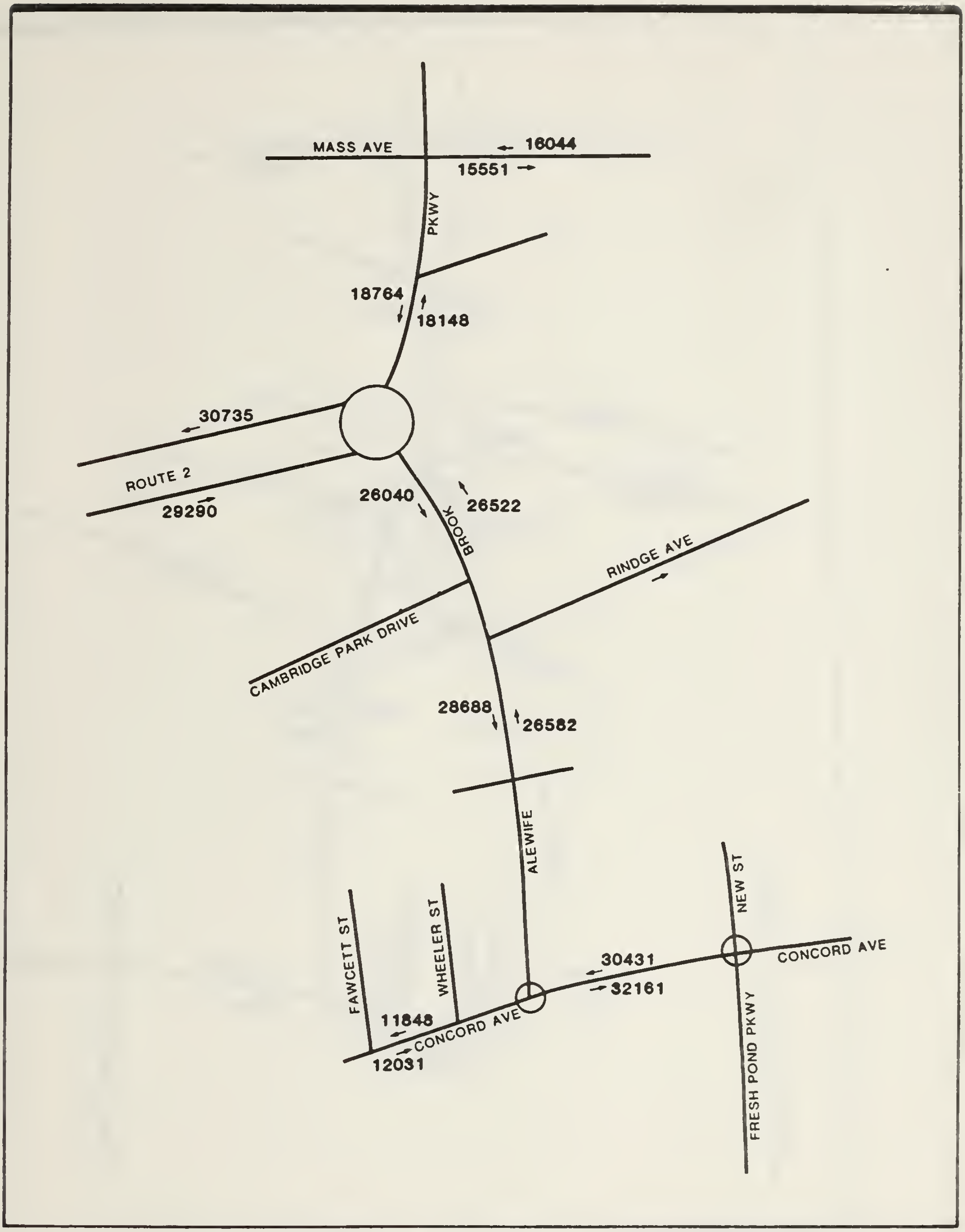
CTPS

FIGURE
H-11

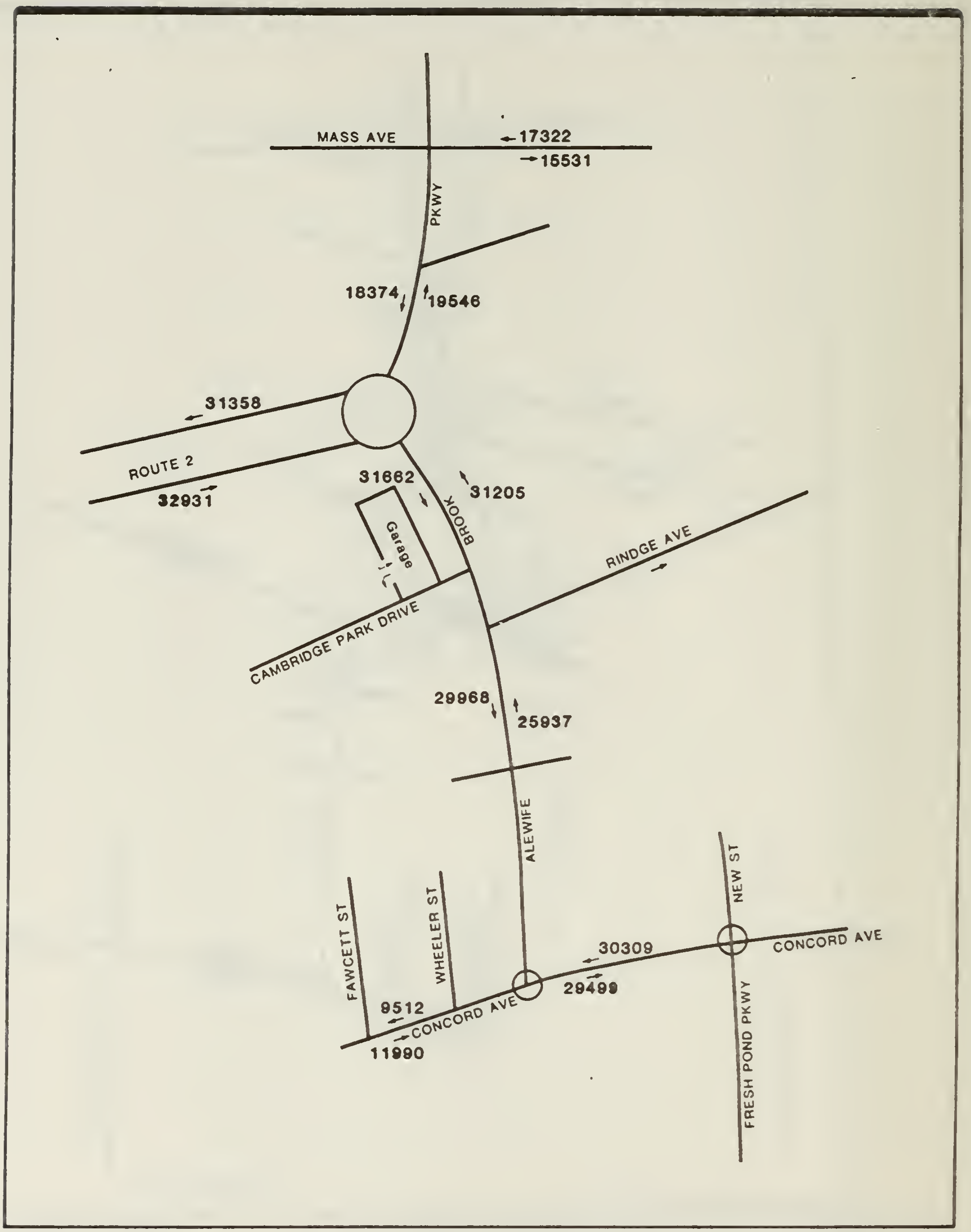


*non-existent, 3/85

Alewife Before/After Study	Weekday Traffic Volumes 3:30-6:30 p.m. % Change From November 1985 to October 1986	CTPS
December 1987		FIGURE H-12



Alewife Before/After Study	Weekday Traffic Volumes 24 Hours March1985	**CTPS**
December 1987		FIGURE H-13



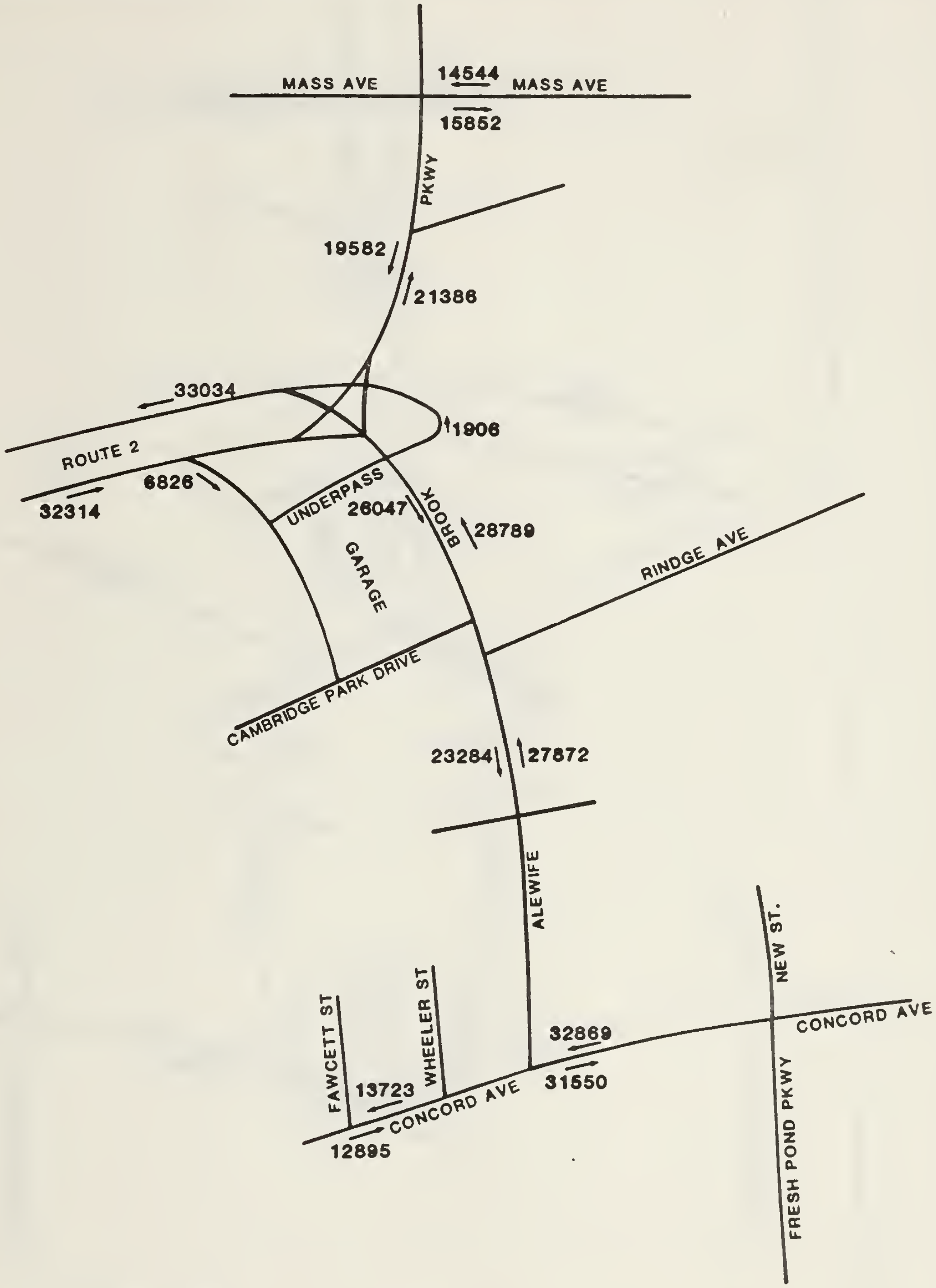
Alewife Before/After Study

December 1987

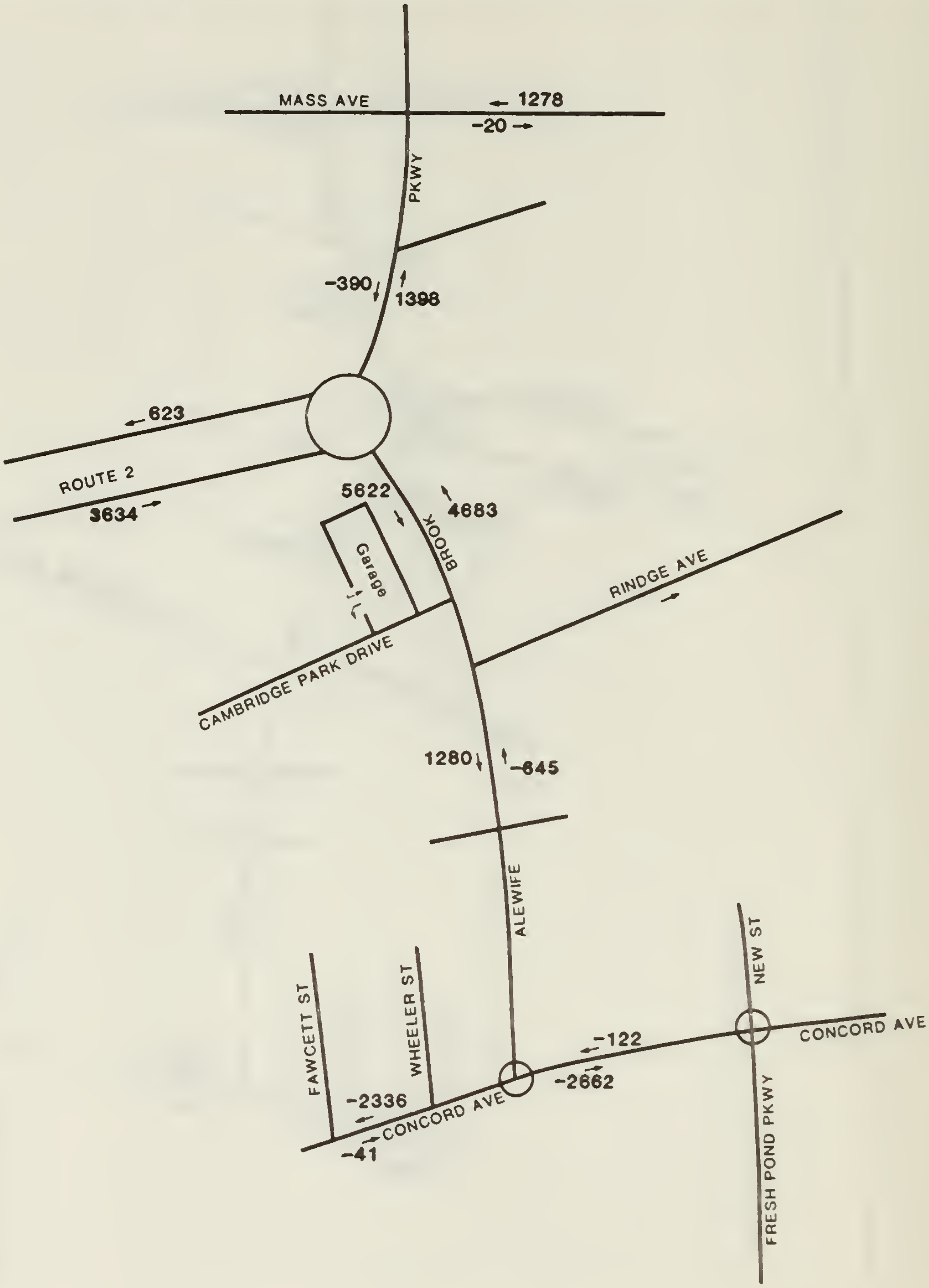
Weekday Traffic Volumes
24 Hours
November 1985

CTPS

FIGURE
H-14



Alewife Before/After Study	Weekday Traffic Volumes 24 Hours October 1986	CTPS
December 1987		FIGURE H-15



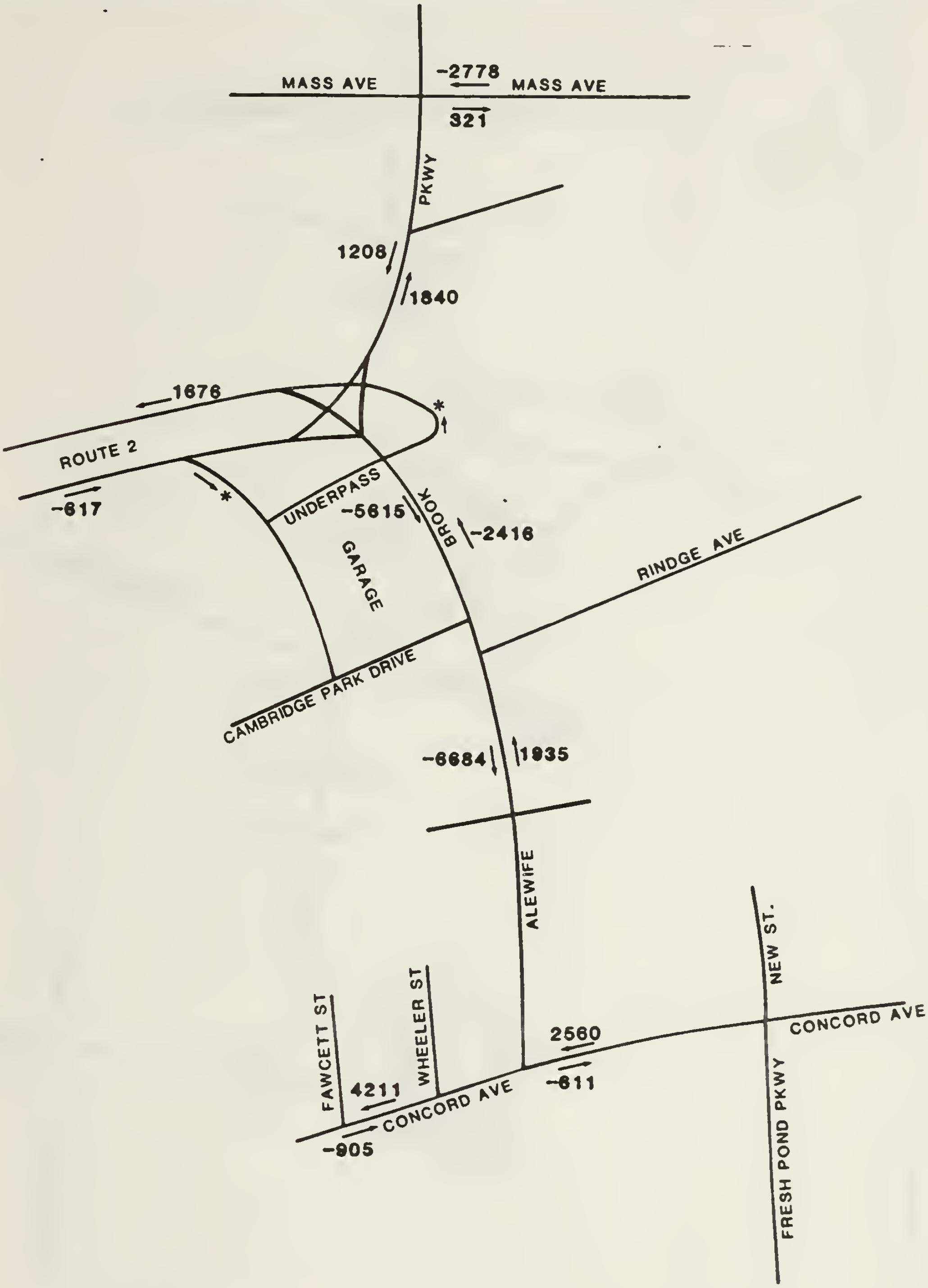
Alewife Before/After Study

December 1987

Weekday Traffic Volumes
24 Hour
Absolute Difference
From March 1985 to November 1985

CTPS

FIGURE
H-16



*non-existent, 11/85

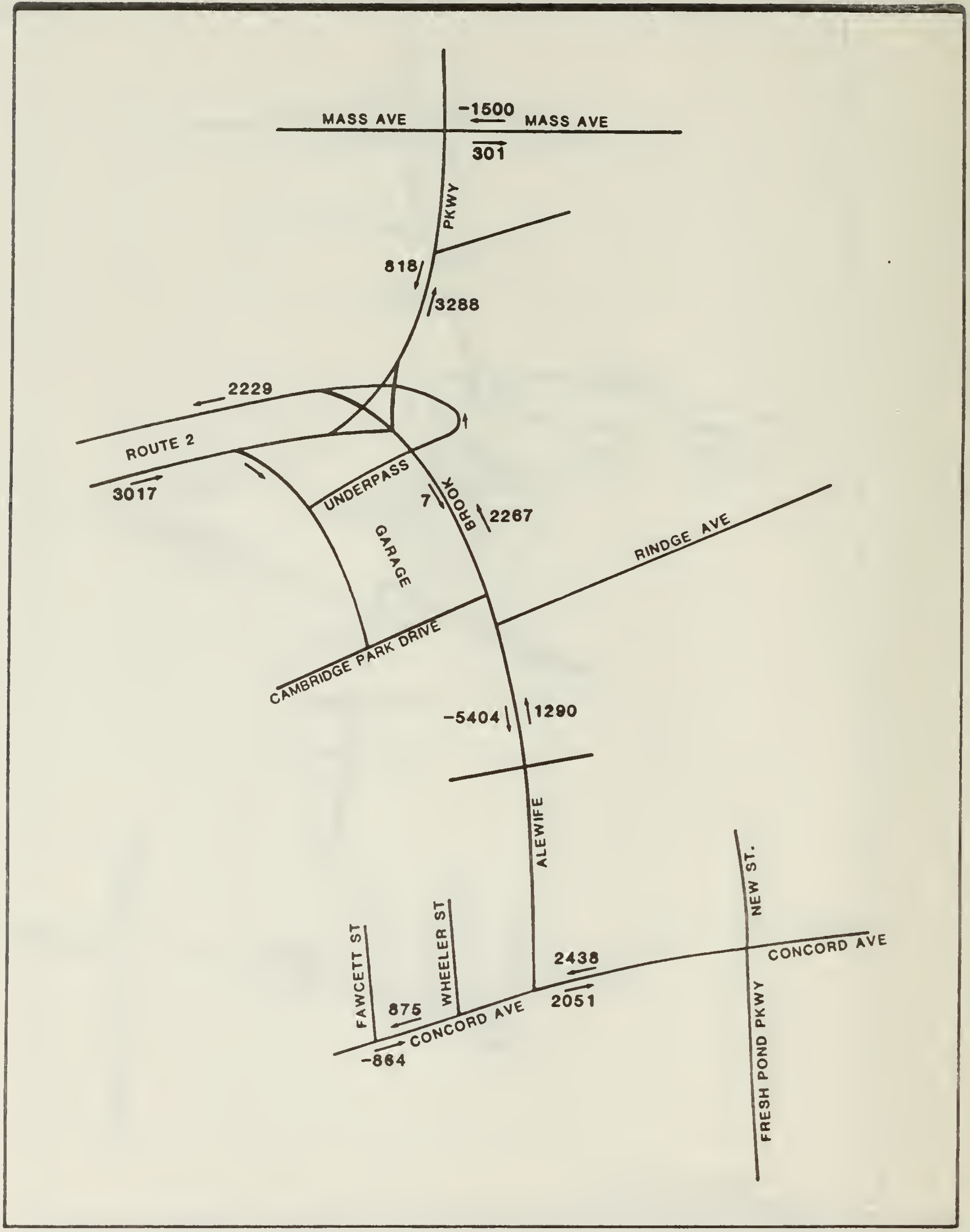
Alewife Before/After Study

December 1987

Weekday Traffic Volumes
24 Hour
Absolute Difference
From November 1985 to October 1986

CTPS

FIGURE
H-17



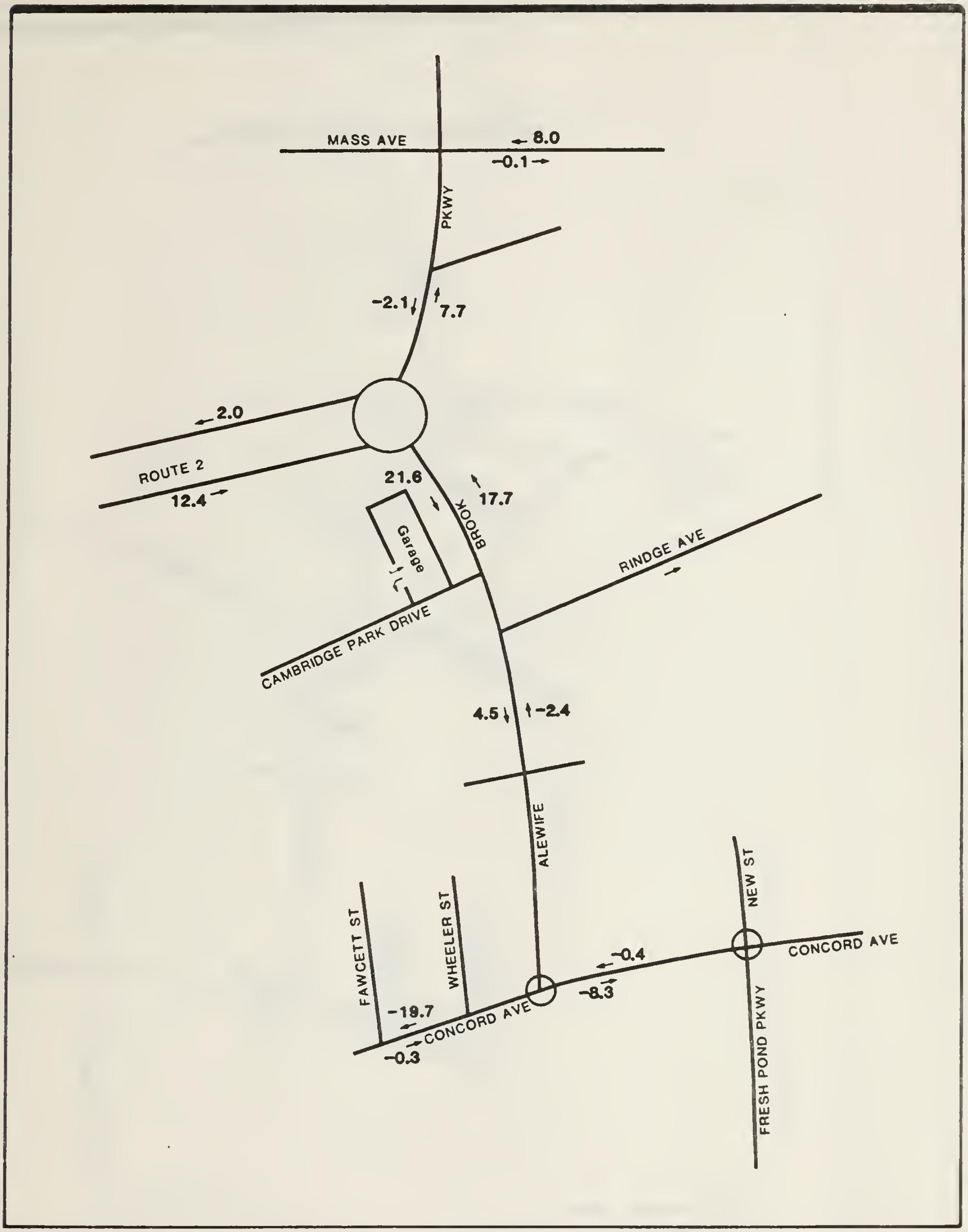
Alewife Before/After Study

December 1987

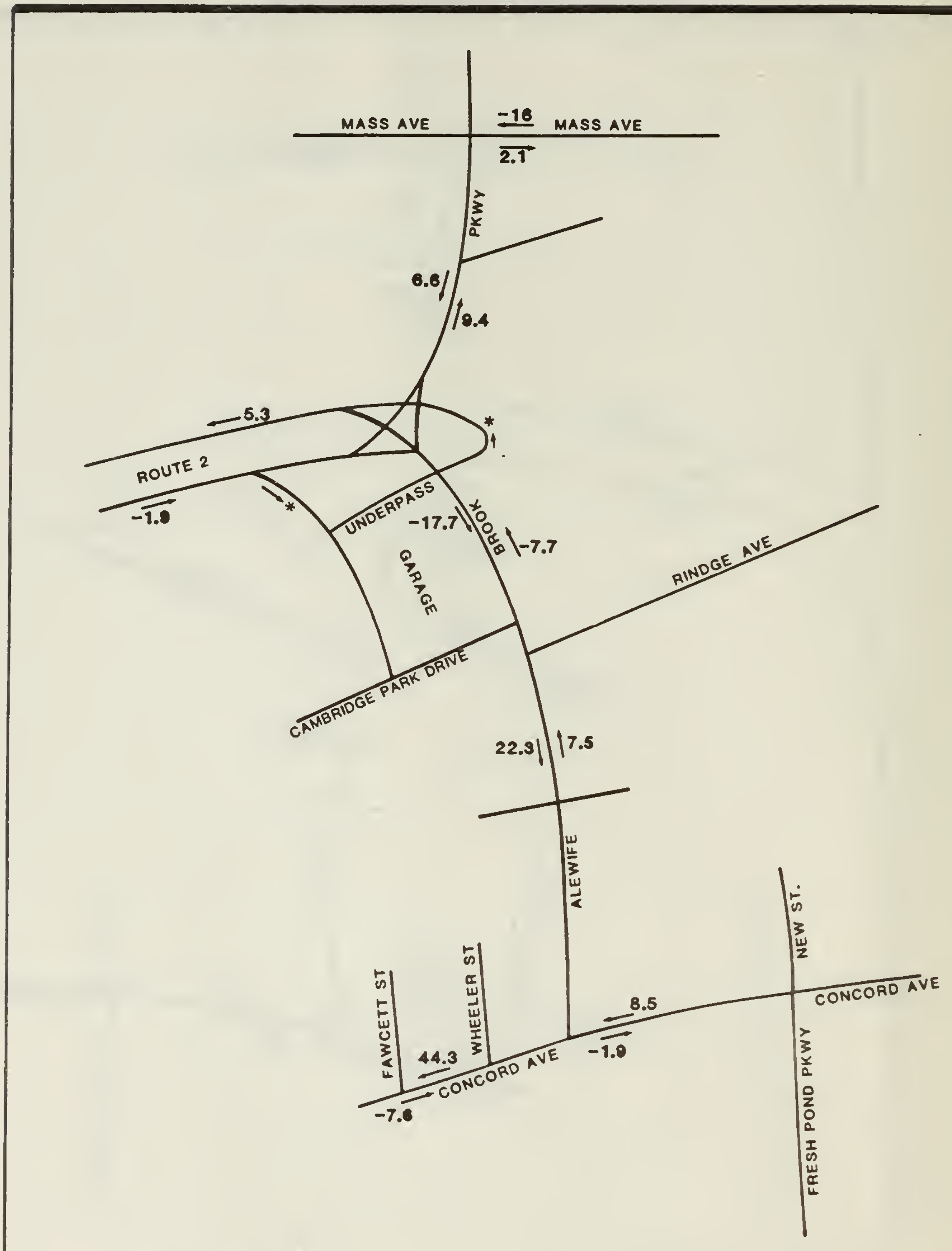
Weekday Traffic Volumes
24 Hour
Absolute Difference
From March 1985 to October 1986

CTPS

FIGURE
H-18



Alewife Before/After Study	Weekday Traffic Volumes 24 Hours % Change From March 1985 to November1985	**CTPS**
December 1987		FIGURE H-19



*non-existent, 11/85

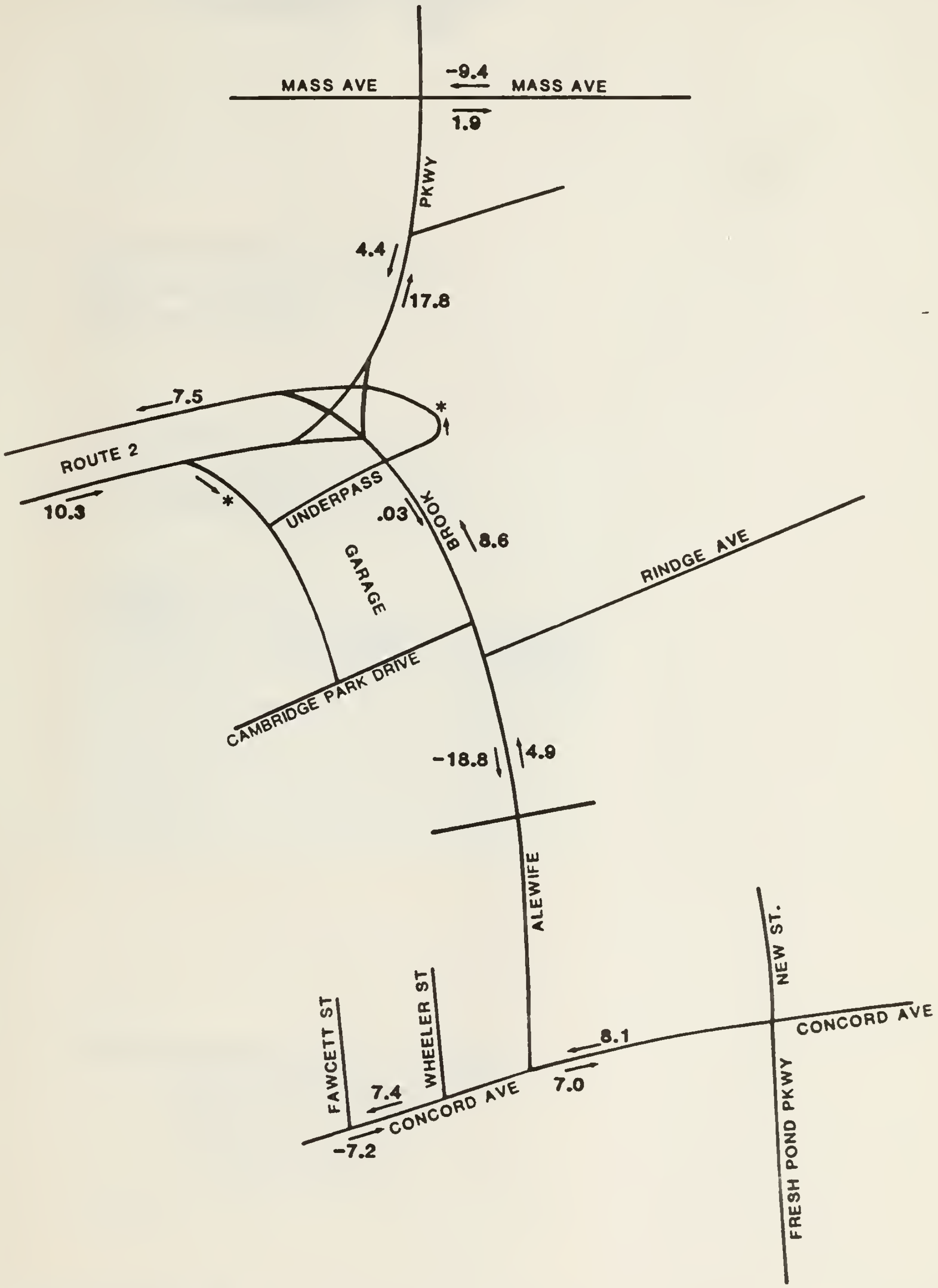
Alewife Before/After Study

December 1987

Weekday Traffic Volumes
24 Hours
% Change
From November 1985 to October 1986

CTPS

FIGURE
H-20



*non-existent, 11/85

Alewife Before/After Study	Weekday Traffic Volumes 24 Hours % Change From March 1985 to October 1986	**CTPS**
December 1987		FIGURE H-21

STATE TRANSPORTATION LIBRARY
3 3100 00025 1198

HE 4491 .B76 R673 1987 c. 3
Red Line extension to Alewife:
efore and after study

IE 4491 .B76 R673 1987 c. 3
ed Line extension to Alewife:
efore and after study

DATE LOANED	BORROWER'S NAME	DATE RETURNED

STATE TRANSPORTATION LIBRARY
OF MASSACHUSETTS
10 Park Plaza, 2nd Floor
Boston, MA 02116